CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION."

Volume 11 SACRAMENTO, APRIL, 1925 Number 2

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THE HALF-POUNDER OF EEL RIVER, A STEELHEAD TROUT.

(With four photographs by the author.)

By JOHN O. SNYDER, Stanford University.

Early in the fall of the year there appears in Eel River a migration of steelheads locally known as "half-pounders." Their entry into the river and progress up stream seems to depend somewhat upon the flow of the water, which may be greatly reduced during the periods of drought. They are usually present in the lower reaches of the river in considerable numbers from the first of October until about the middle of November, when high water permits them to pass up stream.

While yet fairly fresh from the ocean, bright silvery in color, sometimes with a blush of pink along their sides, plump, solid, and full of energy, they are sought by many anglers, some of whom have come from long distances.

Among these fishermen one occasionally hears more or less protracted discussions as to whether the fish are trout or steelheads, whether they belong to the same species as the larger steelheads which enter the river, whether they differ from the smaller stream trout, whether they differ from the steelheads of other rivers, what is a steelhead anyway, etcetera.

The purpose of this article is to present the results of a brief study of these fish and to attempt an answer to some of the queries relating to them.

In California the term steelhead is commonly used to designate a trout that has come into a river from the sea. Such a trout, usually of considerable size, appears with others in a regular migration at a more or less definite time. For example, a migration of such fish takes place in Klamath River during the summer and early fall. The fish appear late in July, become abundant in August and September, after which the migration rapidly declines. They pass up the river in great numbers. Some turn into various tributaries, while others pursue the main channel as far as they are able to go.

The steelhead migration coincides in a general way with that of the king salmon, not only in its rise and decline, but in its periodical irregularities as well, a large wave of steelheads being often associated with a similarly large wave of salmon.

As the steelheads appear fresh from the ocean, sometimes bearing living parasitic crustaceans attached to their bodies, they are of a beautiful steel blue above, with highly burnished, silvery sides. They usually have very definite black spots on the head and body; spots are always present on the dorsal, adipose and caudal, while the remaining fins are immaculate. Sometimes the head is without spots, and the body has very few. The spots of the head are almost always round, while those of the body are elongate and linear. The ova found in these fish are very small, their undeveloped condition giving rise to the suggestion that the steelheads have entered upon a very long migration, or at least a considerable sojourn in fresh water, and this has been found to be true. Their stomachs are usually empty, and they seem to remain so while they are in the estuary of the river. A little farther up stream their appetites appear to return, and their behavior is governed accordingly. They snap a fly or a spoon with avidity, and they severely test the angler's skill in the rapid water.

About the middle of August steelheads that have begun to assume their nuptial colors are occasionally seen in the estuary. The cheeks become tinted with pink, and a broad, reddish blush appears along the sides. At the same time the dark dorcal area loses its marine hue and becomes a light olive. Salt water crustacea are not found attached to such individuals, and it seems probable that they have been in the river for some time. When fresh from the ocean the steelheads may often be seen in numbers leaping high from the water and falling with

a great splash. They seem fairly intoxicated with their new experience in the stream.

In their progress up the river these fish slowly assume the well known color characteristics of the brook trout, and as the spawning period approaches they become very brilliant.

Steelheads enter all California streams which are large enough, sometimes appearing where the volume of water is scarcely sufficient to carry them. These fish have come to the fresh water to spawn, and unless prevented in some way, most of them will accomplish their purpose and eventually return to the ocean. Some die, perhaps from injury, lack of food, old age, or because of a weakened condition after the unusual exertion incident to migration and spawning. A few remain for an indefinite time in the rivers. In many of the larger streams are trout of considerable size which appear to be resident there, and which may never have gone to sea, and some of these have received specific names.

In the Sacramento, and in all streams which enter the ocean to the southward, the steelheads appear to be of one species. They do not differ from, but are identical with the stream trout, *Salmo irideus* Ayres. A brief study of their scales reveals the fact that many of them have lived in the stream for from one to two or even more years before entering the ocean. Some of them have also performed three or more successful spawning migrations.

In the streams of the northern part of the state, the sea-run trout are found to belong to two species. By far the largest number are *Salmo irideus,* but amongst these may occasionally be seen an example of the cutthroat trout, *Salmo clarkii* Richardson. In general appearance the two resemble each other rather closely, when fresh from the sea. The latter may be distinguished by their smaller scales, there being from 160 to 200 in the lateral series. *S. irideus* has from 110 to 145 or so. Apparently the cutthroat trout do not migrate far up stream in this latitude.

It will be seen then that one may speak with perfect propriety of rainbow steelheads (*S. irideus*) and cutthroat steelheads (*S. clarkii*), while in the hands of the angler the steelhead becomes a rainbow trout, or a cutthroat trout when the brilliant stream colors of the fish have been sufficiently developed. Sometimes steelheads are found far up stream, their silvery marine color having not yet changed. These appear to have proceeded quickly up the river after having entered its mouth.

Steelheads are sometimes caught in the ocean. They are then always steel blue above, and bright silvery on the sides, the red longitudinal stripe being entirely subdued.

The steelhead-rainbow controversy is still much alive with some anglers, and indeed some ichthyologists may not agree with what has been written here, preferring to believe that the steelhead represents a species entirely distinct from the rainbow trout. From a careful examination of many trout from our coastal streams, I am convinced that the coarse scaled steelhead and the rainbow trout are identical. Some of the misunderstanding comes from a confusion of terms, the fishes themselves being lost sight of in a mist of nomenclature.

Last fall fourteen samples of the Eel River half-pounder were caught by Mr. W. G. Morse in a pool near Fern Bridge. These were preserved by Mr. T. M. Benson and shipped to Stanford University. They were typical steelhead trout, resembling in every way steelheads of similar size from other streams which enter the ocean immediately north or south of Eel River. All the anatomical characters which one is accustomed to regard as of importance in distinguishing trout species are apparently identical with those of larger steelheads and also of the small stream trout in the river. Furthermore these steelheads do not seem to differ from the coarse scaled steelheads of Klamath River. Their uniformly small size will be accounted for later.

The specimens ranged in length from a little less than 10 inches to about 12½, and weighed from 5¾ to 11½ ounces. Each was a male fish. The testes were not enlarged except in one case.

The scales in the lateral series numbered from 124 to 138 in number; in the series above the lateral line 23 to 26. The vertebrae number from 60 to 64. The following table will serve to show some individual variation of the specimens.

Number	Weight	Length	Vertebrae
202	8 oz.	270 mm.	62
314	10½	300	63
304	6½	260	63
307	10	295	64
308	10	300	63
313	11½	315	61
312	10	300	64
303	8½	280	60
311	5¾	265	63
306	10½	300	62
301	7¾	275	64
310	8½	275	61
309	7½	280	62
305	6	250	62

When ten of these trout were measured and the results expressed in hundredths of the length from snout to base of caudal fin, the average measurements were as follows: length head .228; depth body .234; depth caudal peduncle .10; length caudal peduncle .183; length snout .059; maxillary .11; diameter of eye .416; interorbital width .085; depth head .162; snout to occiput .149; snout to dorsal .468; snout to ventral .525; length base of dorsal .127; length base of anal .106; height dorsal .126; height anal .115; length pectoral .144; length ventral .119; length caudal .195; dorsal rays 11 or 12; anal 11 or 12; scales lateral series 130; above lateral line 24; scales before dorsal 58.5.

Without introducing more details, it may be stated that measurements of steelheads from the Klamath are similar to the above.

Once it is established that the half-pounder is a steelhead trout, differing from the larger steelheads and the smaller stream trout only in size, and by such other characters as one would expect to appear with growth, a determination of the age of the fish in question becomes a matter of considerable importance. In age determination we have recourse to the scales, and it appears that within certain limitations

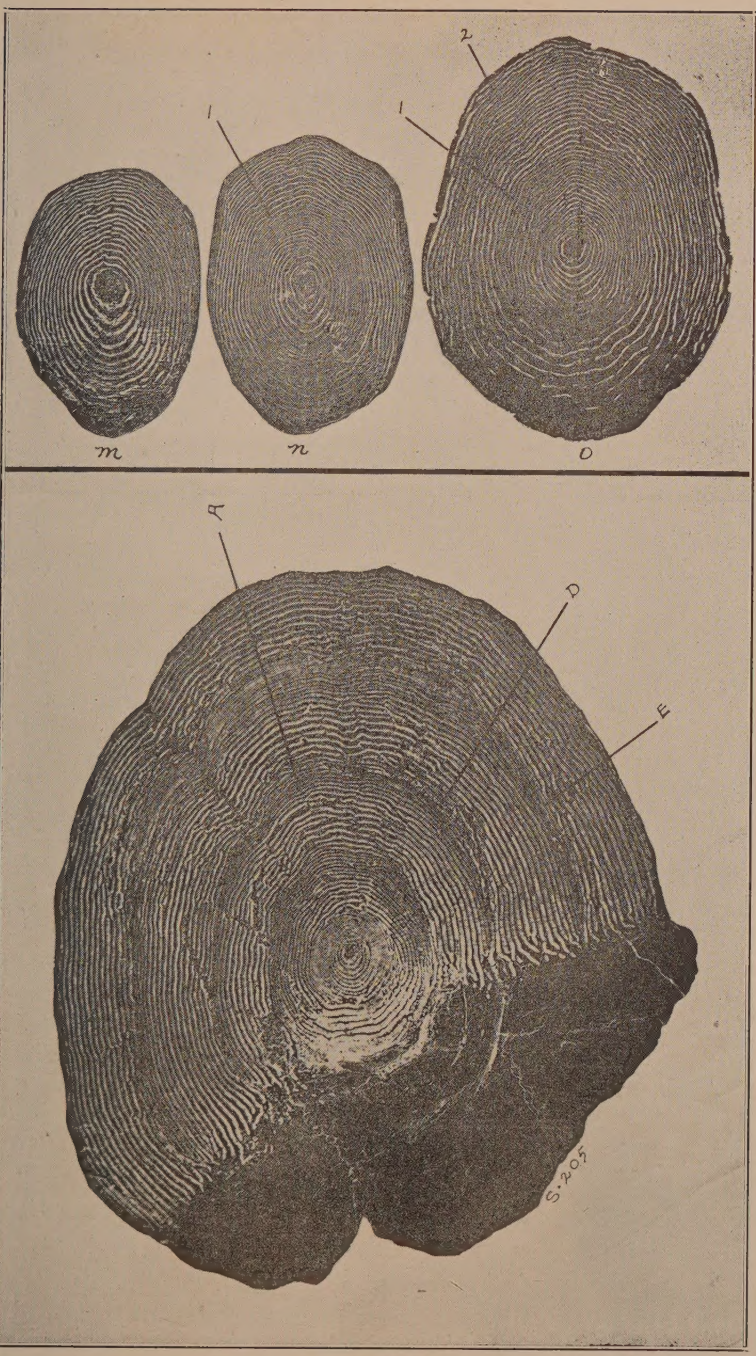

FIG. 14. Photomicrograph of the scales of three stream trout, the first being one year old, the second two, while the third has entered upon the third year of growth.

FIG. 15. A scale of a Klamath River steelhead with a one-year stream record and possibly two spawning records. The fish was apparently five years old.

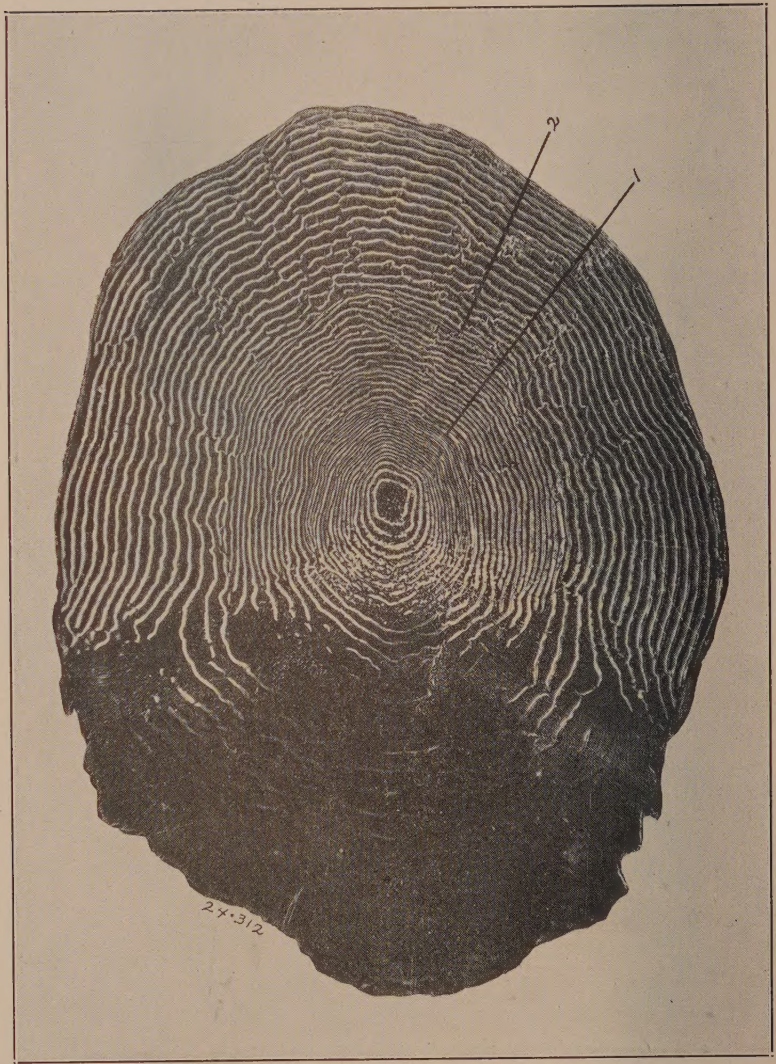

FIG 16. A scale from a small Eel River steelhead which, having spent two years in the river and one in the ocean, has just returned on its first spawning migration.

they may be relied upon to furnish a fund of facts relating to the life history of the species.

In order to obtain a clue to the early growth as reflected by the scales, a number of stream trout from Eel River were examined. It was found at once that these examples, some hundreds in all, fell into two size groups, the first consisting of individuals measuring from 35 to 85 millimeters in length, and the second of examples measuring 116 to 168 millimeters. The latter appeared to be somewhat deeper and heavier fish. One hundred fifty examples picked at random from the first group averaged 62 millimeters in length, and most of them were from 51 to 71 millimeters long.

A scale from one of the larger individuals of the first group is represented by figure *m*, Plate 1. Scales of all the others in the group were essentially like this, except that they were either larger or smaller and with more or fewer rings or circuli. From the condition of the scales of the smallest examples it was inferred that scales first appear when the little fish measures about 30 millimeters. They are then simple plates like the central dark area in the figure, and they rapidly increase in size by the addition of material that assumes the form of growth rings or circuli.

The scales of the second group were like one illustrated by figure *n*, *excepting* two examples which measured 135 and 168 millimeters respectively. The larger of these is represented by figure *o*. The essential difference between *m* and *n* is the presence of an annulus, an area of narrow circuli sharply followed by broader rings, here indicated by the line marked *1*. The larger scale, *o*, exhibits two such annuli, *1* and *2*. The band of broad circuli beyond the second annulus is very evident although much restricted.

After considering what has been observed in the scale growth of other fishes together with what is seen here, it seems safe to assume that the fish of group *1* are in their first year, those of group *2* having scales similar to *n* are in the second year, while the largest of them, represented by *o* are in the third year. The growth of each year is represented by the area which lies within a particular annulus.

Passing now to the scales of the half-pounders, it is found that they are all alike except in minor details. One of them, much enlarged, is illustrated as Plate 2, where it will be seen that an inner part marked *1* corresponds very closely with the entire scale *m*, and that this together with the area bounded by the annulus marked *2* corresponds with the scale illustrated as *n*. The part enclosed by the annulus *2* represents then, a stream growth of two years, while the outer part is plainly ocean growth, the fish being no doubt in its third year. Since scales from all of these fish present essentially the same features as the one figured, one may assume that their life history has been much the same. They are small steelheads, three years old, that have just entered upon their first spawning migration.

If the growth of the fish is reflected by the structure of the scale, it is possible to compute the approximate length of the fish at a given age from measurements afforded by a magnified image of the scale. The computed measurements of the half-pounders at stated ages are

given in the table here presented, and it will be seen that the computed growth of the first year compares favorably with that obtained from measurements of trout of the first year. The same may be said of the second year. The fish were captured after the growth of the third year had made great progress.

Table showing computed lengths at end of first and second years.

No.	1st year	2d year	3d year
301	47 mm.	112 mm.	275 mm.
302	52	113	270
303	80	147	280
304	72	134	260
305	82	120	250
306	91	135	300
307	80	141	295
308	67	126	300
309	50	141	280
310	68	128	275
311	73	144	265
312	69	123	300
313	79	182	315
314	80	138	300

Steelheads with a similar history may be found in Klamath River. A record of ten such fish follows. Some of these are females:

No.	1st year	2d year	3d year	Sex
598	41 mm.	95 mm.	315 mm.	m
597	82	152	330	f
600	71	145	345	m
591	79	137	315	f
594	55	139	330	m
595	56	105	290	f
109	48	114	340	m
368	59	117	330	m
612	44	104	320	f
611	48	122	300	m

In their stream history and migrations all steelheads do not follow the schedule laid down by the half-pounders. From an examination of one hundred steelheads taken in the estuary of Klamath River it appears that these fish often spawn for the first time after having spent one year at sea. They usually enter the ocean at or near the end of the second year. Occasionally one migrates to the sea at the age of one year, and rarely one may be found that has remained three years in the stream. One example had spawned in the second year. None had spawned before having spent a year in the sea. They usually spawn annually after the first time. The following conditions were noted:

No.	Stream	Ocean	Spawned	Age	Length	Sex
540	1 year	2 years	0 times	3 years	270 mm.	m
204	3 years	3 years	2 times	6 years	645 mm.	m
205	1 year	4 years	2 times	5 years	625 mm.	m
206	2 years	3 years	2 times	5 years	635 mm.	m
208	3 years	4 years	3 times	7 years	640 mm.	m
346	2 years	2 years	1 time	4 years	480 mm.	m
350	3 years	2 years	1 time	5 years	530 mm.	m
118	2 years	3 years	1 time	5 years	635 mm.	f
533	2 years	2 years	0 times	4 years	370 mm.	m
604	3 years	1 year	0 times	4 years	345 mm.	m

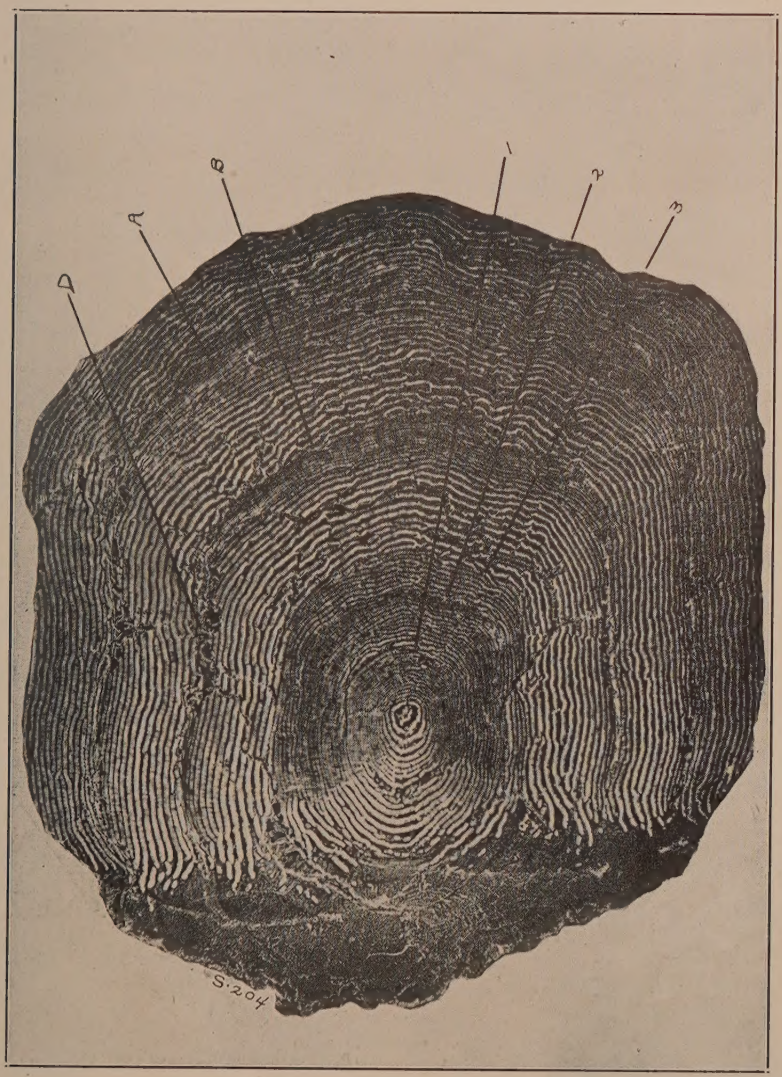

FIG. 17. A scale of a Klamath River steelhead with a three-year stream record. This fish returned to the river a third time after having successfully accomplished two previous spawning migrations.

Plate 3 represents the scale of a fish that evidently left the river in or near the end of its third year. It spent three seasons in the ocean, returned to the stream for two successful spawning periods, and was taken upon entering the river for a third migration. The stream growth is represented from the center outward to a point marked *3*. The first annulus after having entered the ocean occurs at *B*; the second at *A*. If we strip from the scale all that part lying outside the annulus *B*, we shall have have a very good illustration of the scale of a fish that has spawned for the first time. Indeed one may in most particulars duplicate such a scale from fishes taken at the spawning beds.

The edge of such a scale exhibits in places a badly eroded appearance, due perhaps to absorption, and the eroded edge is preserved after the growth of another season has been added, thus producing the well known spawning mark. Such spawning marks are found on two of the scales illustrated, *D* for example in Plates 1 and 3.

It will not do to overlook the possibility that error may lurk in the statements regarding the frequency of spawning and also the age of trout that have once spawned. In some cases a considerable part of the scale may be absorbed during the spawning migration, thus affacing a large part of the growth record, as much in fact as that of an entire season with its spawning activities. A close inspection of these scales will be sure to incite questions which are now difficult or impossible to answer.

It appears without doubt that the half-pounder is a young steelhead, approximately three years old, which has entered the river on its first nuptial migration. If it successfully spawns and escapes the dangers of the river it may return again and again, each time greatly increased in size, and presumably with a larger egg laying capacity.

The angler should be willing to catch sparingly of these small fish through a short season, and every effort should be made to protect the little stream trout, the offspring of the steelheads.

It may not be out of place here to call attention to the well known fact that stream fishing for trout, a major sport in California, is rapidly entering a critical stage. The extension of roads easily negotiated by the automobile, the building of high dams, the netting of steelheads in the rivers, water pollution, the use of water for irrigation, and many other things incident to a rapid growth in population, are causing a marked and sudden depletion in the number of fish. It has been said that intelligent conservation must depend largely on our knowledge of the natural history of the species, and nowhere else is this more applicable. Very often our attempts at conservation serve among other things to bring to the surface our lack of definite knowledge of the habits and life history of the very fish that we are striving to protect. It is to be hoped that active support will be given to the Fish and Game Commission in every effort at careful investigation along this line.

GAME, HUNTER, AND LANDOWNER.*

By John P. Holman.

In years gone by sportsmen had a wide field in which to range. America was sparsely settled and game was plenty. The country adjoining the large centers of population was looked upon as the natural arena where those who followed field sports might roam at will, regardless of the ownership of the land or the right of farmers. Landowners looked upon hunter-trespassers as a matter of course during the fall and winter months. Some posted their lands with warnings against hunting, but few bothered to enforce their rights in the matter, and the hunter usually escaped with a friendly warning or at most he was told that the next time he was caught on the property he would be prosecuted.

Since those far-off happy days, each succeeding generation of sportsmen has faced some new restriction to its activities, the inevitable result of increasing population, until today hunters of limited means are faced with the total abandonment of their favorite pastime unless some new method of adjustment is found between the landowner and the hunter.

The problems of game administration, free shooting, and the rights of landowners are all so closely interwoven that no one may be approached with any hope of permanent solution unless all three are worked out at the same time and with full agreement as to result. The state owns the game, the farmer the land on which the game ranges and the hunter wishes to exercise his right to free shooting.

This three-sided problem is getting all the more complicated because the game is getting scarcer, the farmer is posting his land more universally, and the great army of hunters is each year increasing in numbers.

The only logical solution of the problem is for the state to bend every effort to increase the supply of game, the farmer to arrive at some method of making the game on his farm profitable to him, and for the hunter to approach the farmer in a different spirit than he has shown heretofore and to cultivate a profound respect for the amenities of life. While this method of solution would undoubtedly work out in time, more drastic measures are needed to help the hunter solve his end of the problem, because of the simple fact that all men do not have vision and all men do not have the attribute of self-restraint. The great majority of hunters show consideration for the rights of the landowner, but there are many who do not, and the good have to suffer for the sins of the wicked, as in every other form of human endeavor. There must be some means employed to compel the wrongdoer to walk in the paths of virtue, and laws have been evoked to this end.

Recently the state of New Jersey enacted a law compelling all hunters and fishermen to obtain the written consent of the landowner before they may enter upon posted property to hunt or fish. If a hunter or fisherman fails to do this and is arrested and found guilty, he may be fined $20, and if the trespasser does any damage to the property and the charge is sustained against him, he may be fined

*Reprinted from *Bird Lore* 26, pp. 367–368.

$500. Arrests may be made without warrant by the owner of the land or the lessee, as well as by an officer of the law.

North Carolina has had a similar law for many years and many other states have enacted legislation of like character, but New Jersey is the first state to definitely sustain the landowner in the recovery of substantial redress for acts of trespass.

Such drastic legislation has been brought about solely because the thoughtless hunter has in many instances done serious damage to the landowner. He has broken down fences, tramped on crops, shot cattle or poultry, and even set fire to pasture lands and outbuildings. He has entered upon land which did not belong to him and acted as if it were his right to go and do as he pleased. Naturally he has aroused the resentment of the landowner, and the problem of sportsman and landowner has been brought to a critical stage.

The true sportsman, who is known as such in any community, will only be inconvenienced by this law, however, as in most instances he will be able to get permission to hunt on posted property, but the other class, the outlaws, so to speak, will be compelled to get in line and follow the rules of the game or give up their favorite sport.

Such legislation goes far to remedy the situation in so far as the landowner is concerned, but it does not solve the other two sides of the problem. The state which owns the game and the hunter who wants to shoot the game have yet to be reckoned with. There must be some meeting-ground where all three sides of the problem affecting game may be represented, and this can only be brought about by the organization in each community of an association of which the State Game Commissioner, the hunter, and the landowner are common members, and where they can work together for the best interests of all concerned. Such an organization may be called a Rod and Gun Club, Community Club, or what not, but the main idea is to get the three vital factors of game administration together, to the end that a better understanding may be promoted among them.

Through such cooperation the Game Commissioner would find an added stimulus in his work for the increase of game, the farmer would learn that the game on his land is an asset of no mean worth, and the hunter would come to know that only by carefully regarding the rights of the landowner would he be allowed to hunt and fish.

BIOLOGICAL SURVEY OF THE RAE LAKES REGION.

(With six photographs by the author.)

By Geo. A. Coleman.

In the heart of the most rugged and beautiful part of the southern Sierras, at the head of the Kings River watershed, which is drained by the south fork of the Kings, Woods Creek, Baxter Creek and Bubbs Creek with its tributaries, are situated nearly one hundred lakes of respectable size, worthy of the name in every respect. In this same region and draining into these lakes, are innumerable small lakes, potholes and ponds, formed by the melting snows when there is a heavy snowfall, but which during dry seasons such as 1923 and 1924, may be entirely dry. The summer of 1924 was therefore a particularly good time in which to study the distribution and abundance of the various

species of plant, protozoan, insect and crustacean life of these lakes, with a view to determining the number and species of fish they would support, since the greater number of them are at present, either entirely barren of fish life or supporting a very few species in limited numbers. During the month of September and first half of October this entire region was traversed and a careful survey made of some eighty of the larger lakes.

In the heart of this region lie the Rae lakes, a chain of four lakes situated at an altitude of 10,700 to 10,900 feet—the gems of the entire system. Recognizing this as a particularly favorable breeding ground for the rainbow trout, the Rae lakes together with the Sixty Lake Basin, which lies just adjoining to the west, was set aside by an act

FIG. 18. Middle Rae Lake, "Fin Dome" in background (about 2,000 feet in height and shaped like the fin of a fish, hence the name).

of the legislature and designated as a breeding ground, in which no general fishing is allowed. A very wise provision, since the Mount Whitney Hatchery, at Independence, is largely dependent on the rainbow in these lakes for a supply of eggs.

Examination of the fish in these lakes at the time of this survey showed them to be in excellent condition—the flesh solid and sweet in both adults and young and the females with an abundance of forming eggs. Examination of the stomachs of a number of young fry as well as adult trout, showed that their food consisted of small crustacean, insect larvae with a small proportion of vegetable matter. Careful analysis of the contents of the stomachs of a considerable number showed the

proportion of these to be as follows: 50 per cent consisted of small crustacean, commonly known as "scuds," (scientifically as *Hyalella knickerbockeri*); 25 per cent of Caddis fly larvae; 20 per cent of the larvae of a Midge (*Chironomus* sp.), and 5 per cent of a miscellaneous mixture of vegetable matter—algae, diatoms, etc.

A survey of the waters and bottoms of these lakes showed an abundant growth of Nitella (Order-Charales-Family Characeae-Subfamily, Nitella—to which *Chara, Nitella,* etc. belong), covering the bottom in water from a depth of six to forty feet, the greatest depth found. This growth of *Nitella* affords a most excellent protection and breeding ground for the "scuds" which were found there in great abundance. In addition to furnishing protection, *Nitella* also furnishes a resting place for diatoms and small protozoans which are the food of the "scuds."

The open waters were also well supplied with protozoa and algae upon which the various species of aquatic insects feed. Analysis of the waters for dissolved oxygen and carbon dioxide, showed the water to be normal, *i. e.* 100 per cent dissolved oxygen and carbon dioxide very low (2 parts per million). This was due to the growth of *Nitella,* as has been determined by subsequent experiments with this plant in the author's laboratory.

FIG. 19. A bunch of nitella, new species, just as it is dredged up from the bottom of the lake ready for transplanting.

This excellent condition of the fish—due to well nigh perfect condition of the food supply and environmental conditions—is the result of the first attempt of the Department of Fish Culture in planting the proper food in these lakes. In 1919, several fish transportation cans of *Nitella* and the "scuds," were packed in from Independence and planted in the Rae lakes, which were at that time barren of such food.

Recent studies, by the author, of *Nitella* shows that it is particularly well adapted to transportation and to growing in deep lakes—in fact it is about the only plant that will grow and flourish in the deeper waters of these mountain lakes, where the temperature in the summer rarely rises above 50° F. and in the winter is very much lower. This plant grows by budding new branches from the tip and axils of the old and without roots—so that it naturally drifts to the low places in the bottom. Experiments show that a small piece thrown into the water will at once start to grow and send out new shoots and that it may be half eaten up by insect larvae, or by the "scuds" and still recover.

The "scud" (*Hyalella knickerbockeri*) is a fit travelling companion for *Nitella*, since it too, will live and reproduce enormously under a great variety of conditions, being widely distributed over the United States. In *Nitella* it finds its best protection for breeding since this plant grows and flourishes at a depth below that at which most trout travel. Indeed nearly all the scuds taken from trout stomachs were males—which were probably swimming in the open water when they were captured by the trout.

FIG. 20. Scud (*Hyalella knickerbockeri*), adult male. Note the small front claws by which the male is readily distinguished from the female.

As an example of the difference which the food makes in the condition of the fish: East Lake, which is situated near the head of East Creek, a tributary of Bubbs Creek, is well supplied with insect life, but no crustacean life, such as the "scuds." This lake was stocked several years ago with Loch Leven trout. Examination of these trout during this survey showed that while they had grown to a length of two feet or more, they were lean and thin and the flesh very soft.

The Baxter lakes, at the head of Baxter Creek, at an elevation of 11,300 feet were stocked with Eastern Brook trout a few years ago. This was our first camp on the survey arriving there about 3 p.m. After fixing camp, my assistant went out to get some fish for supper. In half an hour he returned with a string of fifteen beauties. They were in fine condition—in fact the best mess of fish we had during the summer. The flesh was firm and sweet.

Examination of the stomachs of these trout showed that their food was almost entirely made up of water fleas (*Daphnia pulex* and other sp.) along with copepods (*Diaptomus* sp.) a food of which they are particularly fond and which forms a large proportion of their food in eastern waters. This is an example of putting a species of fish in its right environment, since these lakes happened to be already supplied with just the right food for these trout.

FIG. 21. (A and B.) A branch of nitella showing scuds in axils, where they rest and feed on diatoms, desmids, and so forth.

FIG. 22. The "scud" (*Hyalella knickerbockeri*), showing female caught in the act of moulting (i. e. shedding its skin). The distinguishing mark is the large front claws.

It is not possible in the space of one article to chronicle the results of the survey of the other lakes in this region, except to say that the most of them are barren of any of the larger aquatic plants, or higher algae, such as *Nitella,* also of the larger crustaceans. Most of them are

supplied to some extent at least with insect life. Nearly all of them are well supplied with diatomaceae and the fresh water algae, which form the food of insects, protozoa and crustaceans which in turn form the food of the trout. A few are almost entirely barren of insect life or protozoans. Successful planting of trout in such lakes demands a supplementing of the natural growth in each lake with whatever it needs to make good food conditions for the trout before they are introduced. It would be very hard to establish the trout before the conditions are made right and hard to establish the plant and animal life after the trout are introduced as the fish in seeking for food would destroy the introduced species of plants and animals.

MILD CURING SALMON IN CALIFORNIA.

By W. L. Scofield.

Process in Brief.

In past years when salmon were abundant in California vast quantities of king salmon were mild cured and shipped away and salmon mild curing for a time was our leading fishery industry yet very few of us have seen or eaten true mild cured salmon because it is very seldom on sale at restaurants or fish markets. There are several methods of curing salmon and frequently smoked, salted or barbecued salmon is confused with mild cure.

The distinctive feature of mild cure is a slow curing for several weeks in a mild brine as distinct from preserving in a strong brine, salting, smoking, drying, kippering or any of the other processes.

Only one species of salmon is mild cured, variously known as King, Chinook, Quinnat, Sacramento, and Spring. This curing is distinctly a west coast process and is still practiced from Monterey to Alaska. The process very briefly is this: The salmon is gutted, headed and the sides split from the backbone. The "sides" are then scraped or "slimed" and placed in a chilling bath of salted iced water. They are then drained, given a light coating of dry salt, packed in barrels or "tierces," mild brine added and the tierce kept in cold storage for a few weeks. Sides are then taken out, graded and "repacked" in tierces, fresh brine added and the tierces shipped in refrigerator cars. Sides can then be removed, washed, given a light smoke and sold to the retail trade. The "curing" is accomplished in the first brine (before the repack), the mild cure in brine giving the name to the process.

Other Curing Methods.

A variety of other curing methods have been used in California, smoking and sun drying being practiced by the Indians before the whites came to this coast. Small quantities of salmon are salted down in barrels using dry or "hard" salt in such quantities that much free undissolved salt surrounds the flesh in the brine which is formed by the moisture in the fish. The products of various combinations of drying, salting and smoking are often confused with mild cure and sometimes sold under that name in local markets. Kippered salmon is the chief rival of the mild cured as a delicacy. In kippering, the meat is cooked more than cured and is more appropriately called barbecued salmon. In this process the fish is cut into one pound chunks and cured

only about three hours in an 80 per cent brine. It is then washed and dried either by air blast or over a small fire after being strung on wires or placed skin down on wire netting. It is then ready for the principal step in its preparation, the broiling or barbecuing over a hot fire or bed of coals till thoroughly cooked. It is best when served warm from the barbecue but is good the next day. Three days after the cooking it is not usable. Salmon prepared in this way is sometimes served in local restaurants after reheating in the oven.

Mild Cure History.

The process of mild curing salmon is comparatively recent. A number of years ago, particularly at Halifax, the Atlantic salmon, which is a small fish usually not over 12 or 15 pounds, was given a brine cure preparatory to smoking but the process was crude and far inferior to the present method. The fine quality mild curing was developed on the Pacific coast. The first mild cure of king salmon was tried on the Columbia River about 1889, the curing being done in whiskey casks, the product being shipped to Germany but as there was no cold storage about half the fish soured during the voyage. About five years later another attempt was more successful but anything like extensive curing on the Columbia was not practiced till 1896. Salmon were cured in 400 pound barrels but this was not satisfactory as large fish were often broken by being crowded in the barrel. Finke Bros., a cooperage firm in Portland, Oregon, is credited with making the first salmon tierces or large diameter 800 pound barrels that have become the standard container. About 1897 or '98 mild curing started on Puget Sound but was not well established till 1901. The abundance of salmon in Alaska atttracted packers and in 1902 the curing began, starting at Taku Inlet. By 1904 several stations were mild curing in Alaska, the price to fishermen that year being $1 for three large fish. Salmon under 22 pounds apiece were counted two for one but the fish are said to have averaged 30 to 35 pounds with very few small fish. The cured fish sold at seven and a half cents per pound.

Mild curing in California was developed later than in the north, the start being made about 1900 on the Sacramento River, also the home of the first salmon cannery in the United States. About 1901 mild curing started at Monterey and became the chief fishing industry of that bay but recently the sardine canning business has left it far behind. For several years Monterey was the only place in California where ocean caught salmon were cured, the fish being taken by trolling.

In the first days of mild curing the preparation of the preserving salt was a secret process shrouded in mystery and performed as a sort of incantation behind locked doors and darkened windows. One man, about 1897, who knew a formula, offered his services to the highest bidder and performed the ceremonial rite of secretly mixing the product of his formula with the salt to be used. These mysterious formulae contained some sugar, Liverpool salt, several acids and a little saltpeter. Secret formulae were used up to 1900 when they were discarded as it was found that salt alone accomplished the same results. A preserving powder, looking like salt, called "Preservaline" was then used by mixing one pound of Preservaline with 100 pounds of salt for both mild curing and hard salting. In 1909 the Federal Food and Drug Act did away with the use of preservaline and since then only plain salt and water have been used and found to be satisfactory.

Preparing Fish for Cure.

In preparing salmon for mild curing there is a cleaning loss of from 30 to 35%, head, entrails and backbone being removed. Fish under 16 pounds or about 32 inches in length, in the round, are seldom split as that weight is necessary to make the smallest "side" accepted, six pounds. Fish under 16 pounds are either sold to fresh fish markets or canned. Before splitting, the fish is "scored," that is, gashes are cut in the skin to allow a more ready penetration of the salt. The fat or oil of the fish tends to exclude the brine and it is therefore more difficult to cure the fat oily regions of the side. The base of the dorsal fin and just back of the "collar" are particularly oily spots that are frequently the first to show taint in curing. There is a fat layer under the skin but especially along the lateral line there is a triangular strip of dark oily meat that is apt to sour in curing and for this reason the scoring is heaviest along the lateral line, care being taken to cut through the skin and fat but not into the red meat. In removing the head a diagonal cut is made so that a portion of the cartilage from the back of the head remains on the fish for the purpose of holding the flesh of the "side" in place more firmly. In splitting, the cartilage or "collar" is hooked over a sharpened nail in the table to prevent the fish slipping. Two preliminary cuts are made posterior of the body cavity to free the flesh there from the backbone and then one sweeping knife stroke splits the upper side of the backbone. Another stroke removes the backbone, with tail fin attached, from the remaining side. Splitters are well paid skilled workmen with pride in their speed and dexterity in making a continuous knife cut that leaves but a trace of meat remaining on the backbone. After splitting, the sides are thoroughly washed on a "sliming table," more properly called a scraping table because of the importance of scraping to remove blood from the veins of the body cavity as well as to trim loose ends of membrane from the flesh.

Chilling.

From the scraping table the sides go into the chilling tank and if properly chilled the surface veins should not refill with blood to show up as dark markings while the side is curing. The chilling tank is commonly miscalled the "sliming tank," the name probably coming from Alaska where a "sliming tank" provided with scraping shelves is used instead of a scraping table. The chilling tank contains iced brine for the purpose of preparing the sides for curing, the cold brine serving to partially impregnate the outer layers of flesh or what might be called case hardening. Unchilled sides absorb too much of the curing brine and the salt penetrates too deeply at first so that the flesh is over salty with a tendency to become dry and hard later on. Another object in chilling is to hold the fish oil in the sides. Fish a day out of water or exposed to warm air start to ooze oil but proper chilling will stop this. If not properly chilled the oil continues to exude from the flesh in the curing process so that when a tierce is opened for repacking a layer of oil floats on the brine and naturally the buyer wants this oil in the fish, not in the brine. Sides should remain in the chilling tank but two to four hours for the best results but in the rush of a big pack they are often removed at the end of a

half hour. The brine of this tank should be iced to 30 or 40 degrees F. and should be from 60 to 70 degrees salinity in order to properly case harden the sides and prevent loss of oil.

Light Salting.

After chilling, the sides are piled on a cart to drain and are wheeled to a box containing dry salt where the sides are given a superficial coating of salt. Only the salt adhering to the moist surface of the side is used as the sides are packed in the barrel except where two very large sides fall together, in which case a small handfull of dry salt is sprinkled between the fat sides. After the sides are packed in close layers in the barrel they are ready for the "cure."

Tierces.

The barrels or tierces used in curing, storage and shipment are a standard size, holding from 775 to 850 pounds of sides, the normal amount being 800 pounds. Most of the California tierces are made from Douglas fir and shipped knocked down to the curing shed where they are set up as needed.

Size of Crew.

There is little uniformity in the size of mild cure crews, from four to twenty men being employed, depending on the quantity of fish ordinarily received. A proper labor charge is variously estimated at from $7 to $12 per tierce, but this charge necessarily varies greatly because a full crew is often held idle on the prospect of a heavy run of fish being received at any time.

Curing.

The tierce packed full of sides is headed, coopered and filled through a small bung with brine of from 90 to 94% salinity and the tierce is placed in cold storage for the curing process, or the slow penetration of the brine. The time allowed for curing in cold storage may be varied, but two weeks is usually the minimum period and the time may be extended to four or five months, but because of storage expense and a desire to realize on the product the fish is seldom cured more than one month before repacking. In extreme cases of rush orders the time for curing is sometimes reduced to 6 or 8 days by using stronger brine and curing at a higher temperature. In such cases a little salt is often sprinkled on the sides when repacking as the cure is not completed and will continue in transit.

There are several variations in the method of curing. One, sometimes followed in California, the so-called Scotch method, in which the sides are pressed into the barrel and never repacked, which results in about 850 pounds of sides per tierce, but the appearance of the fish is not so good and there is less moisture in the flesh by this method. Another variation is to fill a barrel with sides, let it stand a day to settle and then add a few more sides, press down the barrel head and cooper it without adding brine. The water from the fish forms sufficient brine and when the proper amount of dry salt is used the resulting brine is of about 92 per cent salinity.

While curing, the temperature of the cold storage room is usually kept at about 39 degrees F. At lower temperatures the brine does not readily penetrate the flesh and soft sides are apt to result, while at

higher temperatures there is over curing which yields salty, hard sides, lacking the moist flesh quality so desirable in this process. It is important that an even temperature be maintained during the cure but after the repack temperatures may vary without injury. In shipment there is usually considerable variation in the refrigerator car as the ice melts out and the car is reiced.

Weight Changes While Curing.

During the first two weeks of the curing process there is usually a decided shrinkage in the weight of the sides, amounting to from 8 to 20 per cent of the fresh weight of the sides. After two or three weeks there is a slow gain in weight so that most cured fish, weighed three or four months after repacking, will be found to equal or exceed the fresh weight. Sides over cured regain very little weight after the initial shrinkage.

Repack and Grading.

After the sides have cured sufficiently they are removed from the barrel, graded according to size and defects, repacked in tierces and a 90 per cent brine added. The tierce is then coopered, returned to cold storage or shipped in refrigerator cars. The California packers usually recognize but three or four principal grades with a catch-all grade of "B" and culls, but the B grades of each size class are often thrown together and separated from the culls or worst sides. The B or No. 2 grade is made up of slightly injured sides as distinguished from the badly injured culls but the grades are loosely defined. The culls may include pale, gaffed, burned, broken, small, thin, and poor quality sides. The No. 1 grades (usually four) are made on the basis of weight or size of each "side."

Defects in Sides.

Salmon exposed for even a few minutes to the hot sun will "sunburn," that is, the skin will wrinkle and break away from the flesh and, if cured, the side will be tainted and smell. Sunburning, although one of the most common defects, is the most easily prevented, merely throwing a wet sack over the fish when exposed to the sun is sufficient.

"Belly burn" is due to autodigestion after death of the fish and shows as a darkening of the body cavity and the nearby flesh becomes soft and evil smelling. In more advanced stages the flesh becomes so soft that the ribs break through and the tissue between the flesh flakes breaks down till the fish is unfit for mild cure. It is occasionally necessary to hold fish a day or so before curing but if the fish are cleaned before holding there is of course no chance of belly burning. Ocean caught salmon whose stomachs contain food are apt to belly burn in a few hours whereas stream caught fish with empty stomachs may be held much longer before cleaning, but in any case it is better that fish be cleaned as soon as possible after being caught, whether they are to be held or not.

"Broken fish" resulting from rough handling is a common and serious defect in mild cured salmon. The flakes of flesh are torn apart so that the cured and smoked sides are difficult or impossible to cut in the usual diagonal thin slices for the retail trade. The breaking is not particularly noticeable till the cured sides are smoked and is therefore apt to be passed over lightly by curing crews. Breaking

may occur at any stage in the curing from the time the fish is landed by the fisherman till the side is smoked, but serious breaking is less apt to occur while the fish is in the round. Gaffed fish are often classed with the "broken." A deep gaff hole renders the one side unfit for mild cure and its value to a fresh market is low after the uninjured side has been split away for mild curing.

Each of the above mentioned defects causes a serious financial loss to the packer in that injured sides must be graded down or culled at repacking time and each of the defects results from carelessness or neglect. Sunburn is easily avoided by properly covering the fish, belly burn may be eliminated by prompt removal of entrails, gaffing is unnecessary since a landing net is almost as convenient as the gaff hook, and most of the breaking of round fish and sides may be eliminated by instructing workmen and careful supervision, although some breakage is bound to occur during rush periods. The retention of fins on the cured sides is not a serious defect in that price and grade are not affected. In the California packs only the tail fin is removed.

Color and Fat Variation.

There is such variation in the salmon caught up and down the Pacific coast that mild cure buyers claim they can open up a tierce of salmon and tell which river or trolling point the fish came from. A high oil content is desirable for richness, a thick, large fish is preferred and the redder the flesh the better the sale. Pale colored salmon are salable as mild cure but the "white" salmon are of little value when cured, not because of inferior quality but on account of its appearance. Broadly speaking, the southern catch (Monterey especially) has a high percentage of pale, but few, if any, white fish. In northern California and Oregon nearly all of the salmon are red and further north they are red but with a high percentage of white fish.

The oil content seems to be more variable than color and also less consistent as to locality. The fall runs in the Columbia and Sacramento rivers are too thin for good mild curing but the spring runs in these two streams are the most choice fish for curing, both in color and fat. The variation in the amount of oil may be due somewhat to the preparing of the fish for the journey up the river to spawn. A rule often stated is that the longer the stream the fatter the fish and this seems to be true in general but some other reason must explain the difference in fatness between the spring and fall runs on the same stream. Although of good color, the lack of oil in the fall run of the Sacramento fish is a defect in fine quality mild cure but it has one peculiar advantage. The cured sides are hard and leathery from lack of oil but they will smoke better than the fat sides in extremely hot weather. Ocean and oily spring run river fish can not be smoked during the eastern midsummer heat because the sides begin to spoil and taint in the drying and smoke house.

Sale of Cured Fish.

Most of the California pack is sold and paid for in the state and is usually inspected at the repack by a broker or representative of an eastern buyer. In most cases the packer contracts his seasons pack at an agreed price before the season opens. In the past it was customary to contract at a flat rate but in recent years a separate price is

usually fixed for each of the three or four recognized grades. Shipment east, after the repack, is in refrigerator cars reiced in transit. The cured fish is ready for smoking any time after the repack but may be held indefinitely in cold storage. Mild cure held three years before smoking has met with ready sale.

Smoking.

Practically all smoking is done in the large eastern cities. The cured sides are taken from the barrel in the morning and washed in a tank of fresh running water all day in addition to being washed off with a soft brush. They are then hung in a drying room, provided with hot air blast, for an hour or so till the surface and excess moisture is dried off. Sides are then smoked all night and ready for early morning delivery the next day. Thus washing and smoking occupy about 24 hours. Olive oil is rubbed on the smoked fish, especially on the lean sides.

Sale After Smoking.

In the cities the smoked sides are delivered in the morning by peddlers to the shops retailing the product. The amount smoked is just enough for the day's trade so the smoke is repeated each day. The smoked sides lose color rapidly so they are better used as fresh as possible, but they can be kept over two weeks if held in cold storage after smoking. In the stores the sides are sliced diagonally through the flakes or grain in very thin slices. When the flakes are not solid, as in broken fish, the slicing is difficult and thin slicing impossible. Broken, Bs or No. 2s and culls are sliced thick and put up in olive oil in one gallon sealed tins. Slightly broken fish is sometimes sliced as thin as possible and put up with olive oil in flat or half-pound cans. In shipping the smoked sides to out of town trade they are packed in a shallow box, two sides to the box or four if small, the smoked fish being first wrapped in waxed paper. This smoked mild cure is sold readily in German communities of eastern United States but more is sold to the Jews, especially in New York. It is used instead of meat, taking the place of bacon, as the thin slices are delicious heated in a pan and served with eggs. The slices are largely used in sandwiches. Although a high class trade takes the better grades, great quantities are used in the sweat shops in lunches for the workers. Before the war more mild cure went to Germany than was used in the United States. Now practically all of the California pack is consumed in the eastern cities of this country and very little is sold locally on this coast.

REPORT ON GAME FARMS.

To the Board of Fish and Game Commissioners,
Sacramento, California.

GENTLEMEN: In conformity with your request that I visit the game farms operated by the states of Oregon and Washington to learn the history of their game farming, the mode of operation, the status of game birds, conditions in those states and, more especially, conditions relating to the introduction and propagation of foreign or exotic birds introduced into those states, and whether such introduction has been successful, I wish to report as follows:

I visited the various game farms of those states and was afforded every opportunity to collect the information and data on the practical installation and operation of our proposed game farms. I was very courteously received by the various commissioners of those states whom I met and was taken in charge by the superintendents of the game farms.

Oregon has three farms; one of 48 acres at Eugene; one of 40 acres at Pendleton, and one at Corvallis of 28 acres, with pen acreage of 10, 5 and 5 acres respectively. Three thousand Chinese and Mongolian pheasants and seven hundred Hungarian partridges are maintained on the farm at Eugene as breeding stock, and five hundred or more at Corvallis. The farm at Pendleton is not yet completed but they anticipate making this the largest of all the farms.

So successful has been the operation of the farms that nearly the whole of the state has been well stocked by and through the efforts of the farm management. Oregon reared and liberated 21,884 pheasants during the biennial period of 1923-24, thus adding to the already natural increase of the wild birds previously liberated. This was at a cost of operation and of additional construction and equipment for the three farms for the above period, of $28,158.40. The operations of these farms are conducted by a superintendent and assistant well versed and skilled in game propagation and having a practical knowledge of game culture, and by such other help as is necessary.

The state of Washington maintains two game farms; one at Walla Walla, operated by selected state penitentiary inmates, and superintended by a free superintendent and part-time assistant; the other, at Steilacoom, is operated by a superintendent and assistant and a number of inmates or weak-minded patients of the insane asylum. It is claimed that the most economical and efficient results are obtained at both institutions.

During the fiscal year of 1924, Washington liberated from its farms 21,656 Mongolian and Chinese pheasants and Hungarian partridges, beside retaining a large supply of birds for an increased egg supply. They also carry a large number of domestic hens for setting and brooding purposes which are made self-supporting. All this at an expenditure of $24,715.28, including additions to both farms, additional equipment, salaries and expense. The state budget for the fiscal year of 1925 for game farm expenditures is $24,852.52, or 28 per cent of the entire estimated income of the Commission. This amount may be increased, as Washington considers the upkeep of game as highly essential as the stocking of her streams by propagated trout.

So successful has been the propagation of game birds in these states that introduced game birds, such as bob white quail, pheasants, and Hungarian partridges are now in such plentiful numbers that both of these states have an open season on them, and these birds are much more numerous than the native game birds of those states which were in such a sad state of depletion previous to the inauguration of these farms.

In addition to the above species of game birds, Washington has, it is claimed, successfully imported the Bamboo partridge, Franklin partridge, sand grouse, Chinese pheasant, and several other game bird species. Both from the train and the state highways in both Oregon

and Washington, there may be seen many coveys of Mongolian and Chinese pheasants, Hungarian partridges and bob white quail, the latter being an eastern United States introduction, and now one of the most numerous in the state. The introduction of these birds into Oregon and Washington was a practical failure until extreme, intensive artificial propagation was carried out. A peculiar situation now exists in both of those states, inasmuch as some native game birds are strongly recommended to be placed on the protected list for a number of years, while nearly all of the introduced game birds, domestically raised and liberated, are now on the open list and furnish the sportsmen 90 per cent of the upland bird shooting.

After investigating and carefully weighing every consideration—the area of California compared with either Oregon or Washington, the climatic conditions, number of hunters, previous experience of those states now operating game farms, including California—I can only come to the conclusion that it would be both money and effort wasted to enter into game farming on a small scale. The introduction of game or fish into any state is nothing more than a business proposition paid for by those who partake of the privilege. The depletion of game or fish means the curtailing of the number of hunting and angling licenses.

The initial cost of material, stock birds, domestic hens for hatching, buildings and fixtures, furniture, out buildings, farm equipment, live stock, and auto truck, will involve the heaviest expense.

As you are aware, our Commission has been vitally interested in the problem of maintaining the demands made upon our fish and game by the very large increase in the hunters and anglers of the state, and in a small way we have endeavored to financially prepare ourselves or to pave the way to financing such an undertaking. But this problem can not be met or maintained with our present income. While we have sufficient funds on hand to establish a game farm as a beginning, if California, with its rapid growth in population, is to keep pace with its neighbor states we have not sufficient income to maintain a farm after the establishment of one, if it is to be of sufficient capacity to supply the state.

In the future, as you have said, our fish and game must be hand-made as it is in Oregon, Washington, New York and other states. We must keep pace or go backwards. The sportsmen of the state generally favor an increase of this voluntary privilege tax but if we expect to create and maintain the artificial propagation of our fish and game it must be accomplished in a large, typically California way.

Oregon exacts $3.00 each for hunting and angling licenses to hunt and fish on 96,699 square miles. Washington exacts $1.50 for each county, or $7.50 for a state license, to hunt and fish on 69,127 square miles. California licenses now cost but $1.00 each to hunt and fish on 158,297 square miles of land and water. This should tell the story as to the future.

Yours very truly,

(Signed) GEO. NEALE,
Executive Officer.

Sacramento, February 4, 1925.

CALIFORNIA FISH AND GAME

A publication devoted to the conservation of wild life and published quarterly by the California State Fish and Game Commission.

Sent free to citizens of the State of California. Offered in exchange for ornithological, mammalogical and similar periodicals.

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All material for publication should be sent to H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, Cal.

April 29, 1925.

"The best insurance that the state can take out in the interest of the sportsman and the outdoor lover generally is to see that facilities for study and investigation are enlarged upon. The lack of biological data is, without doubt, one of the greatest single factors in retarding development of a larger conservation program, involving better and wiser legislation and greater efficiency in production."—Emmeline Moore.

GOVERNOR RICHARDSON PRAISES COMMISSION IN BIENNIAL MESSAGE.

"This department (Fish and Game Commission) has been able to conduct its affairs on the economy budget in an efficient and businesslike manner. The savings effected in overhead has made it possible for the commission to build up a surplus and this surplus will be expended in building new fish hatcheries and in other improvements. The policy of economy has proved worth while. I have cooperated with the department in every way to put it on an efficient basis and to assist in seeing that fish and game are protected from commercialized exploitation. Every dollar of fees derived from the sportsmen has been, and will continue to be, expended in the interests of game preservation in California. No attempt has ever been made to take a dollar of the fund of the Fish and Game Commission and transfer it to the general fund, notwithstanding the continued prevarication of yellow journals upon this subject."

THE WHEREWITHAL.

California is a rapidly growing state. Greater and greater demands are being made upon the fish in the streams and the game in the game covers. There is continual demand for more game, more fish, more effective law enforcement, better protection. To keep up with the growth of the state and the needs of fish and game resources, increased funds for conservation work are needed.

Everyone who hunts or fishes, and everyone interested in wild life must admit that the following projects are urgent at the present time.

1. A greater output from the state's hatcheries to replace the toll taken by the 225,000 anglers.

2. Some means of increasing the stock of upland game birds with the possible use of artificial propagation.

3. A better enforcement of present fish and game laws by means of an increased patrol force.

The sportmen of the state are demanding these very things and are offering their support to the extent of increased hunting and angling licenses. Certainly it can not be expected that this need can be met with the funds now available.

A PLAIN STATEMENT.

The anticipated plans of expansion intended to be carried out by the Fish and Game Commission in the last half of this 76th fiscal year and for the coming period of the 77th and 78th fiscal years, call for a large expenditure, all of course, within its resources.

Our commission insists that a balance sheet of $100,000 be carried for emergencies, which is sound business, especially so with an institution which is self-supporting and with no reliance on support from another source. The total unencumbered available resources as of December 31, 1924, were $269,518.59. In addition to the above amount a bond deposit is now held in banks to the sum of $88,251 which covers books of licenses furnished to agents on deposits of their full face value for sale to those who desire them. This sum is encumbered and can not under law be considered available until all claims for redemptions of licenses are liquidated, consequently this amount or some portion can not be credited as available until the close of the calendar and fiscal years. A portion of this acount is credited to our available funds when an agent reports the sale of a book of licenses.

Anticipating the large expansive plans necessary to maintain the enormous demands upon our wild life, a most economical and saving plan was insisted upon during the last period. We deemed it very unwise and unbusinesslike to build a structure until such time as we were

sure our income could maintain it. Our commission could not make future contracts alone on recommendations from sportsmen that the license fees would be increased, but only upon such definite action as the legislature may see fit to take, irrespective of the fact that we could have expended all our funds had we so desired, as we believe we could have done because the Governor has given our commission deficiency appropriations to the amount of $141,911 over and above the amount budgeted for the 76th fiscal year. We continue to await the actions of the legislature regarding the amount of increase of our revenue derived from license fees, should the legislature now in session so agree. Our income from licenses at this season is very meagre, consequently we must depend upon our available funds until such time as the income from some forms of licenses begin to come in.

We have funds on hand sufficient only to continue our present activities and to commence our development, later to complete our plans and maintain them. These plans call for a 50 per cent increase in warden service which will then be 25 per cent less than the number which the state of New York now maintains. New York has 143 wardens compared with California's 80. The area of California is 158,297 square miles. A California warden's quota of patrolling this area is 1,907 square miles. A New York warden's share of its 46,000 square miles of area is but 322 square miles. Fish and game propagation is useless unless it is given necessary protection. Our plans call for five new hatcheries and egg-collecting stations sufficient to maintain them with the necessary assistants, together with pond-rearing systems costing $40,000. Our plans call for at least two new river and bay patrol launches. Those we now have, have seen useful service but are worn and antiquated. More trucks for fish distribution are needed. We plan on one or more game farms. Fish and game are now hand made. Man has improved upon nature. Artificial trout and salmon propagation improves natural hatching 95 per cent. A California quail lays 14 to 18 eggs in a wild state. In captivity she lays as many as 50 in a season. Pheasants, likewise, in a greater ratio than quail. This illustrates that wild life must be maintained by artificial means if California is to maintain her name as the summer and winter playground of the world.

Fish and game resources, together with climatic conditions, are one of the most attractive assests a state can have.

Washington now maintains three game farms and Oregon three, maintained from funds furnished by sportsmen. The sportsmen of California are willing to finance a game farm and not one penny will come from those who do not enjoy its product. The license is the most cheerfully contributed of all voluntary privileges. Washington sportsment pay $7.50 for a state license and $2.50 for a county license. Oregon sportmen pay $5.00 for a combination hunting and fishing license. The little state of Nevada exacts $1.50 for a license, while California's hunting and angling licenses are but $1.00 each.

FISH AND GAME COMMISSION
GEO. NEALE, Executive Officer.

WHY INCREASE THE COST OF HUNTING AND ANGLING LICENSES, AND SOME HISTORY THEREOF.

From the year 1870 to 1907 the hunters and fishermen of the state managed to poke along perfectly contented with the very generous legislative appropriation of from $5,000 to $30,000 for the biennial period out of the general funds of the state to propagate fish and enforce the laws relating to its fish and game.

The funds were obtained by direct taxation of the people at large. The small amount appropriated was supposed to maintain the two trout hatcheries and about the same number of paid game wardens to enforce the game laws in the second largest state in the United States, containing a relatively large population of aliens compared to other states. The greatest demand was made upon our streams and fields by market hunters and fishermen for their own and the dealers' profit and who were not even required to pay a tax to help replenish the streams and marshes they had begun to make barren.

This condition dragged along until 1906 and 1907 when the taxpayer awoke to the fact that he was being taxed for something from which he received no return. After eighteen other states had found it necessary to impose a license to maintain its wild life resources, California fell into line and imposed what was termed by its opponents "an iniquitous tax" of $1 annually for a hunting license, which permitted one to legally kill two deer per season, fifty ducks per day, all of the wild geese one could kill at any time, together with twenty-five quail, doves, numbers of rabbits, wild pigeons, sagehens and grouse; he could also catch fifty trout, or twenty-five pounds, per day during a long, extended open season. All, mind you, for $1.

In 1914, owing to the increase in population and larger demand made upon the streams of the state and the inability of the legislature to make an appropriation for fishcultural purposes, another so-called "iniquitous" license of $1 was imposed for fishing, for the privilege of taking fifty trout a day, also striped and black bass, salmon and other of our native and introduced fishes. From the beginning, both of these licenses became the most cheerfully paid volunteer tax of any imposed. So generous were the laws relating to limits and seasons that the Commission could make no advancement, even by using the strictest economy in every branch of the service—a board of commissioners serving without compensation and a warden service, one of the most dangerous and underpaid of any state services, having to enforce game and fish laws against a foreign element who recognize no law except that of force as administered by the officer.

Other states, progressive in game conservation, had applied the license principle as far back as 1872. California was the nineteenth state to adopt the hunting license and has maintained the price at which it was originally adopted up to the present time. Today every state in the United States exacts a resident and non-resident license. Nearly every state has found it necessary to increase the cost of hunting and angling licenses to maintain the wild life of the state, while California remains the same as in 1907. All of the western states, except California, have learned that the conservation of wild life of the state which is so ardently sought, requires finances to accomplish results and all have applied that principle except the State of California.

The question is: What shall we do to maintain this call of the open and maintain the open door of the playground of the world? Since man's scientific methods have improved upon old Mother Nature's own handiwork in the production of fin, fur and feather to an extent of at least 75 per cent, and as California's wild life must be handmade for the folks of today and for the coming generation, shall we drift along and make no progress and wait until it is too late, or shall we advance as other states have. It seems logical that some provision must be made to artificially propagate and maintain fish and game for those who wish to partake of the privilege of its pursuit. The old cry that the fish and game are the privilege of the rich only is not true—at least, not in California. There are 18,891,661 acres of United States forest reserves in California that belong to the people of the state where persons are privileged to hunt and fish by the payment of the small fee required by the license act, governed by seasonal and limit regulations. Owing to its diversified climatic conditions, California may yet, by artificial propagation of its fish and game, lead all states in the splendid incentive to out-of door recreations; but it can not be accomplished by the picayunish policy of a dollar license, which is the least amount exacted by any state for a like privilege.

The state of Washington commenced with $1, but their fee now is $7.50 for a state license for hunting and fishing, or $1.50 for each county in the state. Oregon commenced on the $1 list, but now exacts $3 for each license or $5 for both. In both of these states introduced game species are more plentiful than in any other state, a condition which came into being with the increase in licenses.

In 1874 our Commission imported and hatched 60,000 Eastern Brook trout eggs from New Hampshire. Under the license system we have progressed to such an extent that we hatched and planted 30,568,000 trout and salmon fry last year. To keep pace with the demand we must hatch and plant twice this number.

Perhaps the greatest handicap in our work is the fact that while California exacts but $1 each for hunting and angling licenses, 10 per cent of this is paid for commissions to the sale agents. The 90 per cent remaining purchases but about 50 per cent of prewar values. This should tell the story.—Geo. Neale, Sacramento, Cal.

COMMISSION URGES UNIFICATION OF FISH AND GAME PROTECTIVE ASSOCIATIONS.

Problems facing those who believe in the conservation of natural resources increase annually. Unless all friends of conservation pull together there is little hope for worth while accomplishments. To follow up the advantage gained by the great Klamath victory of last fall the thirty or more fish and game protective associations should be unified into a state body, and sportsmen in every county urged to organize and affiliate with this state organization. This program could be accomplished easily at this time, for the California Conservation League is a representative body of sportsmen in whom each individual organization can have the greatest confidence. The plan includes a central meeting of delegates to be called this spring to perfect the state-wide league. The Fish and Game Commission

does not wish to sponsor this organization and prefers that it be entirely independent of the Commission. The Commission does feel that if the backing of such an independent organization could be obtained for conservation measures, the work of attaining worth-while ends would be made more simple.

DEMAND FOR CONSERVATION LECTURES INCREASING.

There is increasing demand from schools and other organizations for illustrated lectures dealing with conservation problems. The Commission's motion pictures are in constant use and there is growing demand from the various men's service clubs for luncheon talks. The work of developing a public sentiment favorable to fish and game conservation seems often to be unappreciated, but in reality it is the most fundamental of all the means to be taken to conserve natural resources.

COMMISSION ENFORSES GAME REFUGE BILL.

During the early part of February telegrams were sent to representatives at Washington by the California Fish and Game Commission urging the adoption of the Game Refuge-Public Shooting Grounds bill, providing the bill is amended to obviate certain possible dangers so far as the interests of the California sportmen are concerned. This stand for the measure is not the stand taken by most of the western fish and game commissioners, who seem to believe that the charges of bureaucratic control and the inadequate returns for the funds furnished is insufficient to bring support to the bill. The Oregon Commission recently went on record as definitely opposed to the measure. The bill was passed by the house on February 20. Whether it will find equal support in the senate is doubtful.

SEVERAL COUNTIES DEMAND CLOSING OF QUAIL SEASON.

Although there are optimists who claim that quail are still holding their own, yet strong evidence against this point of view is at hand when sportsmen unanimously demand a wholly closed season. Conditions are such in Monterey and San Benito counties that a concerted effort is being made to have the season on valley quail closed for a term of years. Representatives at the legislature have been so instructed. Sportsmen in Santa Cruz County also report quail very scarce and are about ready to join the ranks of their neighbors. A like demand comes from Sutter County, which shows the necessity of artificial propagation.

FIG. 23. Cottonwood Creek from east side. The cross shows location of racks used at the Cottonwood Creek Spawning Station near Hornbrook. Spring freshets greatly hindered spawning operations during early February.

BOUNTY LAW AGAIN DEMANDED.

So regularly does a bounty bill appear at each session of the legislature that those in charge of fish and game legislation would fear that something had gone wrong should one fail to appear. The

bounty bill before the present legislature is modeled after those offered at past sessions. One bill provides that one-fourth of the total income from hunting licenses be spent in the payment of bounties.

Named as predatory birds are the so-called destructive hawks given no protection by law, and then there is added the sparrow hawk and the roadrunner, two of the most valuable birds in the state from the standpoint of the rancher who desires help in the destruction of various insects and rodents. In all, ten birds are placed under the proposed bounty system, the bounties ranging from one cent for English sparrows to fifty cents for the larger hawks and the great horned owl.

Apparently, a serious attempt has been made to prevent fraud in the payment of bounties as the bill contains four and one-half pages of provisions as to the claims and payment of bounties.

"CAUGHT WITH THE GOODS."

Deputy G. O. Laws rounded up a violator in Trinity County this spring who was honest enough to admit his guilt and who, though an old offender, actually wrote and signed a statement admitting his guilt and promising to appear in the justice court on a specified date. A fine of $25 was imposed.

BUREAU OF FISHERIES SUCCESSFUL WITH BLACK BASS.

As a result of systematic experimental work this past year, fifteen acres of ponds were made to produce 150,000 three to six-inch black bass for a net expenditure of about $600 plus the rental of the swamp, and the part-time salary of a Bureau of Fisheries expert. This is the result of intensive work undertaken by the United States Bureau of Fisheries. It is estimated that about 95 per cent of the small fish turned out of hatcheries and dumped at an early stage die or are devoured by predatory fishes. This new method of rearing fish in natural yet protective places where the fish can be reared to large size appears to be the better and cheaper method. It is expected that stocking of the prairie states streams will be better cared for as a result of this experiment. The black bass is particularly suited to the waters of these states.

THE KAIBAB DEER DRIVE.

The much heralded plan of driving large numbers of dear from the Kaibab National Forest across the Grand Canyon into Arizona resulted in failure, as many who are acquainted with the habits of deer prophesied. On December 14th the drive started with twelve Indians on foot and twenty-five white men mounted. The weather proved bad for the photographers and when it proved necessary to drive the deer over seven miles of trail where they had to go single file, the deer scattered in all directions. It is even stated that during the course of the drive as many deer followed the Indians with their cow bells as were driven ahead of the party. Inasmuch as two of the proposed methods of reducing the herd, that of trapping and selling them for restocking purposes and that of driving them into territory where more feed is available have failed, the last method suggested by the investigating committee, that of modifying the hunting regulations will probably be tried out.

PHEASANTS ON DECREASE IN SAN BENITO COUNTY.

For a number of years Dr. McComber spent large sums of money in rearing ring-necked pheasants. These were distributed on his large ranch, near Paicines, San Benito County, California. The birds were very much in evidence for a number of years but now, in the same locality, a ring-necked pheasant is seldom seen. What the factors are that are concerned in the decrease have not been determined.

A SCIENTIFIC VIEWPOINT.

We can not eat our cake and have it too. We can not utilize our forests for the rearing of cattle and sheep and expect native wild life to hold its own. The best statement on this subject we have seen is the following from Joseph Grinnell, Director of the Museum of Vertebrate Zoology, excerpts from an article entitled "Wild Animal Life as a Product and as a Necessity of National Forests" which appeared in the Journal of Forestry, Dec. 1924, pp. 837-845.

"No amount of game laws, the perfect control of hunting and fishing, will bring an improvement in output of wild animal life *unless* there be provision of adequate food and shelter for it. If the food be appropriated by live stock, and the natural cover be destroyed by browsing or trampling by live stock, the output of wild life will inevitably continue small; not only that, but it will shrink down even to the vanishing point in the cases of many sensitive species. We will then have lost, beyond retrieving, many animals of positive use in the maintenance of the healthy life of forest trees, many animals of marked esthetic and recreational value, and many animals of direct commercial value."

"You can not make two things of the same biological predilections occupy the same space at the same time. There can not, in my understanding of the situation, anywhere or ever be a so-called 'maximum' output of live stock and an ideally abundant output of wild animal life from the same area at the same time. Sheep and cattle, goats and hogs, are animals which introduce entirely new features into the organic inter-relations in forests. Wild herbivores can not compete with domestic herbivores on anywhere near equal footing. Live stock is taken into lowlands in the fall after having stripped the forage from the mountains, and the native herbivores are left there to do the best they can with the meagre residue at the severest season of the year. They starve, and their reproductive vigor is reduced. It is the food supply available at the season of *least* supply that determines the *maximum* amount of resident animal life that can exist. Take off most of, or all of, the grass, herbs and browse during the summer and there will be little or no crop of hay or seeds or fruits to carry the native wild animals through the winter and spring before the next crops grow."

AUTOMOBILES AS ANIMAL KILLERS.

Everyone who has motored on the highways of California has noted jackrabbits, snakes and opossums, which have met death under the wheels of automobiles. Those who drive at night have noted that animals are blinded by the headlights and seem to be unable to escape impending danger. In *Science* for January 16, 1925, Dayton Stoner of the University of Iowa records the finding of 225 reptiles, birds and mammals, representing 29 species of native and introduced vertebrate animals, all noted on a trip of 632 miles over Iowa roads. Thirty snakes were counted, domestic fowls to the number of 26, and red-headed woodpeckers numbering 53, were the most numerous birds, and the Eastern spermophile with 18 had the record among mammals.

Should anyone care to keep similar records for California there would be forthcoming evidence that the automobile not only plays a part in taking men to the hunting and fishing grounds, but that it plays an important part in the actual distruction of native fauna. It would have been interesting to have compared the human toll on a similar mileage. Even though the human being may have greater dexterity in avoiding such casualties yet we all know that the toll in this direction is altogether too great.

VALLEY QUAIL FORTY YEARS AGO.

San Diego was once noted for its quail shooting. In the early nineties the birds were so abundant that ranchers complained of the depredations and invited their friends to come and help kill birds without limit in order to protect crops. The manager of the Coronado Hotel was one who regularly invited friends to shoot quail on his ranch. Law enforcement forces raiding the larder at this same hostelry once found 3,000 birds in cold storage. An inadequate fine of $25 was all that was assessed. Such were the conditions of 40 years ago. Investigate conditions in the same locality at the present time and practically no quail are in evidence.

THE PREDATORY MAMMAL.

The attitude of the average sportsman as to the predatory mammal is expressed in the term "vermin." Sporting magazines are full of articles placing most of the blame for the decrease in game upon predatory species. Arms companies have been able to organize campaigns of extermination and similar campaigns are continually urged by sportsmen. By way of contrast, it may be stated that scientists are beginning to point out that much of the antipathy toward the predatory mammal is not backed by evidence obtained from a study of food habits. Furthermore, it is becoming apparent that predatory animals have a real place in nature and that because they feed upon animals in which we are interested is not a valid excuse for organizing campaigns of killing. Where would we end if we started in consistently killing everything that eats something else.

In the February number of the *Journal of Mammalogy* are to be found three articles pertinent to this subject. One entitled "The Scientific Value of Predatory Mammals" by Lee R. Dice, makes the plea that the extermination of any species, predatory or otherwise, in any faunal district is a serious loss to science for it eliminates all chance of future studies of relationship.

E. A. Goldman of the United States Biological Survey defends campaigns against predatory animals by pointing out that the balance of nature has been completely overthrown and that progressive expansion in the future demands exploitation of unutilized natural resources. Large predatory mammals destructive to live stock and to game, he says, no longer have a place in our advancing civilization.

A still more pertinent article backed by stomach analysis is that by Joseph Dixon

of the University of California Museum of Vertebrate Zoology, entitled, "Food Predilections of Predatory and Fur bearing Mammals." The paper contains the summary of food habits obtained by the

FIG. 24. Captured violators of the spiked buck law with the evidence. Deputy Sellmer who made the arrest stands at the right.

examination of more than 1400 stomachs of mountain lions, wildcats, coyotes, skunks and other fur bearers. The food predilections of the various species are displayed in graphic form so that convincing evidence brings one to agree with the author "that in California certain so-called predatory mammals such as the wildcat and the skunk are, in the aggregate, beneficial and not harmful to human welfare." The actual figures, taking all reliable sources of information into consideration, show that 63 per cent of the food of the wildcat in California is of beneficial significance with regard to

man's interests while 10 per cent is neutral and only 27 per cent is of harmful significance. In the case of the skunk, the data obtained from an examination of somewhat over three hundred stomachs show that from man's viewpoint 68 per cent of the skunks' food is of beneficial significance, 27 per cent is neutral, and only 5 per cent of harmful significance.

"Conditions elsewhere may or may not be similar to those in California." In view of these and other similar findings Mr. Dixon believes that, in many instances, where extermination is advocated, we are getting "the cart before the horse." He firmly believes and we agree that it would be best for all concerned to have first a fair and impartial determination of the facts as a basis for a much needed, sane, administration of the animal assets (or liabilities) in question.

CANNERS APPROVE SCIENTIFIC WORK.

"Packers during the year expressed desire for increased attention to research work on tuna on the part of the State Fish and Game Commission, especially with a view to solving problems concerning the scarcity of albacore. It was felt that good work along this line was being done by W. F. Thompson at the San Pedro Laboratory of the Commission but that more should be accomplished by providing adequate funds, assistants and equipment for the purpose."—*Pacific Fisherman Yearbook*, January, 1924.

RECORD CATCH OF WHALES.

"Trinidad station of the California Sea Product Company broke all previous records of that company during the month of May, 1923, taking 29 whales in seven days with a gross weight of about 1740 tons."—*Pacific Fisherman Yearbook*, January, 1924.

IN THE DAYS OF NO LIMIT.

In the early nineties most hunters killed all the birds they could in a day.. There was considerable economy in the matter of ammunition but no economy in the number of birds taken, for those not usable at home were shipped to the market. When someone at a Cordelia club suggested a gentleman's limit of 200 birds, he was dubbed a crank, and when another brave sportsman suggested that 60 birds were enough for anyone, he was almost mobbed.

About 13 years ago, when geese received no protection, the man who could not get 200 to 400 geese in a day for the market was considered a poor shot.

CAPTIVE ELEPHANT SEAL DIES.

A northern elephant seal, which has been on exhibition for several months in the San Diego zoo, died on December 20. This was probably the only animal of its kind on exhibition anywhere. It was secured from the sole remaining herd to be found on Guadalupe Islands off the Mexican coast. The specimen is to be mounted and will be on exhibition at the Museum of Natural History in Balboa Park.

Mexico has declared Guadalupe Island a federal sanctuary and has stationed a garrison of soldiers on the island to protect these last remaining and one of the most interesting of sea-dwelling mammals.

SAN DIEGO COUNTY WANTS WILD TURKEYS.

The Fish and Game Protective Association is backing a movement to stock San Diego County with wild turkeys. In this they are having the active support of S. A. Boulden, chief forester in charge of the Cleveland National Forest, who is planning to secure the birds from Arizona at a minimum of expense by cooperation with the United States forest rangers in that state. If the proper localities are selected for the liberation of the birds, it would seem that there is no reason why the wild turkey should not be established in San Diego County.

JUDGE FINES THREE MEN FOR KILLING SPIKE BUCK.

One hundred dollars each was the fine imposed by Judge Helmore of Sausalito upon Joseph Parella, Joseph Bertolino, and Morris Bruno, arrested by Deputy W. B. Sellmer, August 3, 1924, for having in their possession a spike buck. When apprehended by Deputy Sellmer, the hunters had the illegally taken buck well concealed. It had been securely tied to form a small package, put into a sack, and hidden in the bottom of their auto under blankets and cooking utensils. The men plead guilty when arraigned in court.

ARE ELEPHANT SEALS DESTRUCTIVE?

Fishermen's complaints in regard to sea lions and like animals are an old story. The most recent complaint comes from the vicinity of San Diego where fishermen tried to maintain that elephant seals from Guadalupe Islands make excursions into California waters and play havoc with sardine and tuna fishes. Dr. Barton W. Evermann of the California Academy of Sciences comes to the defense of these animals and points out that little or nothing is known regarding the food or food

habits of the elephant seal. To contend that it is destructive to valuable food fishes is not at all warranted.

Formerly elephant seals were found in abundance as far north as the Santa Barbara Islands upon several of which there were large rookeries. The species is now extinct except one small herd on Guadalupe Islands, about 200 miles south of San Diego. When the elephant seals were abundant, the tuna, albacore, bonito, sardines and other food fishes were vastly more abundant than they now are. The elephant seal is not responsible for their decrease. The responsibility rests entirely with the commercial fisherman.

Instead of exterminating the small herd, the sole remaining remnant of this interesting species, every possible effort should be made to rehabilitate the herd to its former size so that it would be then a commercial asset worth many thousand dollars annually. Fortunately, the Mexican government appears to be in earnest regarding the protection and conservation of these animals.

WHALES ABUNDANT ALONG COAST OF MEXICO.

Whales, which apparently have established a winter home between Cape San Lucas and Cedros Island along the lower coast of Mexico, have been so numerous that not only have Pacific coast whaling vessels been kept busy but Norwegian whaling boats have also been attracted to the vicinity.

Between September and February more than 800 whales were taken, according to newspaper reports, as many as ten having been taken in a single day. Specimens taken have ranged in weight from 35 to 100 tons and in value from $400 to $3,000 each.

Although a few finbacks and sperms were captured the humpbacks were by far the most numerous. The fact that no specimens of the grayback have been found is further evidence that this species was exterminated by oldtime whalers.

OYSTERS, CLAMS AND FISH KILLED BY POLLUTION AT MOSS LANDING.

Large quantities of eastern oysters planted in sloughs near Moss Landing on Monterey Bay, as well as numerous clams and striped bass are reported to have been killed, supposedly by poisonous waste material discharged from factories into the Salinas River. That the poisoned fresh water did not pass into the sea, as formerly, was due to several factors. The mouth of the river had become choked with sand, owing to the action of the ocean, and the heavy February rains raised the back water to a point where the river flowed into an old channel emptying into the south fork of the slough near Moss Landing. Further, high tides held the water back in the slough with resultant damage to fish life. Shellfish interests are planning to take action by enforcing the laws which forbid the dumping of any material deleterious to fish life into any of the streams or coastal waters of the state. Federal regulations also exist.

THE HUNTER'S REWARD.

"Many hunters returned unsucessful," says a news report commenting on the hunting season. No real hunter ever is "unsuccessful." He may not bring game back to the city, but he returns a better man physically for the outing.

There is more to hunting than the killing of game, just as there is more in fishing than in catching fish. The stay-at-home giggles inanely when he sees an angler or gunner trudging home at twilight with empty creel or bag, but if he only could get it through his obtuse skull the laugh is really on him. Of course, there are pot-hunters and fishermen whose hoggish practices bar them from the ranks of decent sportsmen, but they are not the men who come home from stream or woods empty-handed.

The true sportsman delights in the game rather than the score. A full creel or a well-filled bag is his trophy of success. But he knows that no man can hope to win all the time and he is quite content when he returns empty-handed, for he has had healthful recreation and has communed with nature in a manner that only the outdoorsman knows. He has learned new lessons from brooks and trees, from fishes in the streams, from animals in field and woods; he has smelled the sweet odors of the forest, he has in his nostrils the tang of field and moorland, he has seen pictures artists have striven to paint, he has found: "Books in the running brooks, sermons in stones, and good in everything." There is no such thing as an unsucceessful hunting trip.—*Wilmington Journal.*

EATING LEAD SHOT CAUSES POISONING OF MANY DUCKS.

Lead poisoning due to eating shot is a malady of various species of wild ducks which of recent years has attracted attention among persons interested in game birds in the United States. It is thought by the Biological Survey that a number of species in addition to those about

which facts are known may have been poisoned in the same way. At present little can be done about lead poisoning beyond calling attention to its prevalence and describing its cause and symptoms.

From year to year a large quantity of expended shot is deposited in the mud about shooting points and blinds in marshes, shallow bays, and lakes. Many birds find and swallow these leaden pellets while searching for food and become seriously affected by the poison thus taken. The mallard, canvasback, and pintail ducks and whistling swans have suffered most. It is believed that the trouble is generally prevalent throughout the country.

Sportsmen and others interested in this condition among wild ducks will find further details in the United States Department of Agriculture Bulletin 793, Lead Poisoning in Waterfowl, by Alexander Wetmore of the Biological Survey. The bulletin may be had while the supply lasts by addressing the Division of Publications, United States Department of Agriculture, at Washington, D. C.

MORE COOPERATORS NEEDED TO COUNT BREEDING BIRDS.

For several years past the Biological Survey, United States Department of Agriculture, has conducted researches intended to throw light on many problems concerning the distribution of bird life. One of the chief means employed has been to make bird counts, or censuses, through which information is furnished as to the exact number of the pairs of birds actually nesting within the boundaries of selected tracts of land. It is very desirable that this work be continued on an increased scale, and the cooperation of volunteer observers interested in bird life is asked by the department.

Information is needed regarding the numerical distribution of the birds breeding in different sections of the country, and on different types of land; the relative numbers of different species; and the fluctuations that take place in bird life. Bird censuses are the only means of obtaining much of this information. Knowledge of the approximate numbers and relative abundance of both game and insectivorous birds is a prerequisite for the proper administration of Federal and other laws for bird conservation. Data are needed to show what effect existing laws have had; how much birds have increased under protection; and what species have been most affected.

The department has no funds to pay for this work, but must depend wholly on the assistance of volunteer observers. The help received in the past has been greatly appreciated, and it is hoped that it may be extended. Detailed instructions for taking and reporting the censuses, with necessary blanks for the reports will be furnished on request, addressed to the Biological Survey, United States Department of Agriculture, Washington, D. C.

LOCAL NAMES OF BIRDS.

A study of the local names of American birds leads one to believe that our citizens delight to invent names for the species in which they take interest. In almost any region names for certain birds can be found that are not used elsewhere. Hence it is possible to collect rather long lists of names for birds that attract popular attention. For instance 92 local names are known for a single species of wild duck, the ruddy. In this case as in others some of the names have a touch of humor or local color that renders their study a constant pleasure. The ruddy duck for instance gets such appellations as booby, dumb-bird, and sleepy-head because it is slow to take alarm; and others like hard-head, leather-breeches, and shot-pouch because so often it safely emerges from a perfect rain of shot. It has various derogatory nicknames among the mildest of which are dinky, blatherskite, and fool duck.

The study of the local names of birds is not for interest and pleasure solely but has utility in that the proper local names of birds, must often be used in legal proceedings in order to secure convictions by juries or even by judges for violation of bird protective laws. Some of the state laws especially refer to various birds by local names, and it is evident at once that it would be useless to indict anyone for illegal shooting of the chewink when the local protective law lists the bird as the joeree.

For the use of federal and state wardens and for distribution to all interested in the general subject of bird names, the United States Department of Agriculture has published an illustrated and indexed catalog of more than 3000 local names of migratory game birds. This publication, Miscellaneous Circular No. 13, treating names of the ducks, geese, swans, cranes, rails, shorebirds, divers, and the bobolink may be obtained as long as the supply lasts upon request addressed to the Office of Publications, United States Department of Agriculture, Washington, D. C.

TRUMPETER SWANS ARE NOW PROTECTED COMPLETELY IN UNITED STATES.

Trumpeter swans, very few of which are in existence, will be given complete protection in the United States, says the United States Department of Agriculture. Not even will federal permits be issued for taking them for scientific purposes. Along with whooping cranes they have been completely excepted from the list of migratory birds which may be taken under such permission. By action of the Acting Secretary of Agriculture on November 12, 1924, approving a recommendation of the Biological Survey, trumpeter swans were included with whooping cranes, which were similarly protected by the department in 1922. Neither of these two species may be taken in the United States for any purpose. Complete protection is also afforded both species in Canada.

Under the provisions of the treaty with Great Britain for the protection of migratory birds, certain birds, including swans, are given continuous protection through a closed season for a period of at least ten years following the going into effect of the treaty. Provision was also made in the treaty whereby all protected species should be taken under proper permit for strictly scientific purposes.

So far as known there are but very few trumpeter swans in existence, and it was deemed advisable, in order to prevent the complete extermination of the species, to afford them absolute protection by removing them from the list of migratory birds that may be taken under scientific permits, as was previously done with the whooping cranes.

SPORTSMEN FORM STATE FISH AND GAME LEAGUE.

A large number of enthusiastic, red-blooded sportsmen met last night in the Shasta room of the Native Sons' building, and laid the foundation of an organization to be known as San Francisco County Conservation League.

George Campe, president of the Automobile Association, was unanimously elected president, Dr. E. R. Westphal, vice-president; Manley Harris, secretary, and Leon Carroll, treasurer. A board of five directors will be named to assist the officers in drawing up the constitution and by-laws and to give the organization the proper publicity.

Several hundred names have been secured of men who are willing to help in the work of preserving California's great game resources, but many were unable to attend the initial meeting on account of an important B. P. O. E. meeting.

The total wealth of the state game aggregates a greater amount than that of the state live stock, and the revenue poured into state and civilian coffers from that source is tremendous. The preservation association will work in conjunction with the State Game Commission and to increase the stock of game in depleted communities.

The deer of the state, as shown by statistics, are the only game to be increasing, while that of fish and fowl is reaching a perilously low stage. Fowl farms will be instituted and prison labor used to forward the work. The organization, although to be non-political, may have a strong influence upon state game laws.

FACTS OF CURRENT INTEREST.

Duck hunters throughout the state report that shooting this past season was the poorest in many years. Whether this is to be accounted for by actual decrease in numbers or by a natural fluctuation is difficult to determine.

The biennial attempt is being made by cattlemen and sheepmen to have all protection taken from the black bear on the plea that it is destructive to range cattle and sheep.

Popular opinion appears to favor prolonging the present closed season on gray squirrels until 1927. It will be remembered that owing to disease gray squirrels almost disappeared in the eastern mountainous section of the state.

Reports are to the effect that more cattle were killed during the last open season on deer than during any other hunting season. If the hunter expects cooperation from the cattleman, he will have to earn it by having more consideration for his property while hunting deer.

Barracuda have been larger and apparently more abundant off the coast of southern California this year than is usual.

Spring freshets caused havoc at many of the egg collecting stations, in many instances washing out the racks completely and delaying spawning operations for considerable periods of time.

An unusually fine run of steelhead trout was noted in all coast streams this spring. High water cleared the mouths of most of the streams making access easy for the fish.

There is increasing call for literature on fish and game from teachers and students showing that conservation is being taught more widely in the public schools of the state.

HATCHERY NOTES.

W. H. Shebley, Editor.

BROWN TROUT PLANTED ON CATALINA ISLAND.

Development of a water supply on Catalina Island will mean much to anglers for the resultant reservoirs will be capable of producing good angling. On promise that the fishing will be kept open to the public, the Commission furnished 10,000 full blooded brown trout for stocking these reservoirs. The shipment was made on July 19, 1924.

BROWN TROUT PLANTED IN SAN DIEGO COUNTY.

A shipment of 240,000 brown trout was made to San Diego County last summer

Fig. 25. Prize-winning photograph in the 1924 South Bend Bait Fish-Photo Contest.

to be used in planting Lake Henshaw in the Warner Valley. Lake Henshaw is a large lake belonging to the San Diego Water Company. Originally, the plan was to stock it with bass but the suggestion of the Fish and Game Commission has been followed and the reservoir heavily stocked with pure blood brown trout. Reports are to the effect that fish are growing rapidly.

TROUT FRY VERSUS TROUT FINGERLINGS.

The word trout "fry" is often applied loosely to any small fish. More and more the various fish and game commissions are attempting to define fry as against "fingerlings." In the early days of fish-cultural operations, it was customary to hold the fish only until the yolk sac was absorbed and then to place them in the stream. This precluded the trouble and expense of feeding thousands of young fish. Increasingly it has become fishcultural policy to hold the fish in nursery ponds until they are two to four inches in length, believing that such larger fish are better able to care for themselves and escape from enemies when planted. At any of the larger hatcheries in California will be found what are termed "brood" ponds and "nursery" ponds, the latter being utilized in holding the fish until large enough to plant. At the Mount Shasta Hatchery, neighboring lakes have been rented as nursery ponds for salmon.

Although in the past the term fry has been used to denote small fish planted in the streams of the state, it should be strictly understood that the fish in reality had been held and fed at a hatchery until they were from two to four inches in length—in other words they were, in reality, fingerlings. Because of misunderstanding on the part of many, care will be exercised in the future to distinguish between fish from hatching to the absorption of the yolk sac termed "fry," and those which have been held and fed until two to four inches in length—"fingerlings."

SPORTSMEN AID IN PLANTING FISH.

Acknowledgment is made of splendid support of the sportsmen's clubs and other interested parties in the distribution of trout. For several years it has been impossible to send hatchery employes with all shipments of fish. It has been necessary to place dependence upon those interested in stocking streams. Many are the men who spend a whole night and day without sleep caring for shipments of trout and seeing to it that they reach the stream in good condition. Cooperation in fish planting appears to grow better as the years go by. Furthermore, the work is being done more efficiently because there are more trained workers. In some instances sportsmen's clubs and county supervisors have established resting pools at the end of auto roads where fry are deposited and given a few days of rest before being carried by pack animals to the more inaccessible lakes and

streams in the higher altitudes. The Fresno County Sportsmen's Club and the Madera Rod and Gun Club should be mentioned in this connection.

It is believed that this wholehearted cooperation on the part of anglers means better appreciation of conservation work and more interest, with resultant better protection to the fish placed in the streams.

COMMERCIAL FISHERY NOTES.

N. B. Scofield, Editor.

AVERAGE LENGTH OF MONTEREY SARDINES.

Questions are frequently asked as to the size of sardines caught and packed at Monterey. The fact that the sardines caught vary in size from small in summer to large through the winter months makes a general average somewhat misleading unless it is borne in mind that the figure given is only an average. The average size of sardines delivered to Monterey canneries throughout the year is 205 millimeters body length. Translated into inches, the average size is 8.1 inches body length, that is, from tip of nose to the end of the flesh at the base of the tail fin. The average total length, that is, from nose to tip of tail fin is nine and a half inches or a half inch longer than a page of this magazine. The portion of the fish put into the can is about three-fifths of the total length. The above average length may be accepted as accurate since it represents the measurement of but a few less than 47,000 sardines taken at regular intervals throughout four fishing seasons, that is from November, 1920, to March, 1924. Through the first three seasons a representative sample of 100 fish was measured each day deliveries were made to the canneries and during the last season (1923–24) a sample of 200 fish was taken two days each week. The average size for different seasons varied from 202 to 207 mm. body length.

Naturally such a large number of measurements were not made for the purpose of obtaining average lengths. They were made rather as a necessary step in a careful study of such questions as success of spawning seasons, fluctuations in abundance, and natural and artificial depletion as part of our conservation work in fulfilling our duty to the owners of the fish, especially the interested owners, the readers of this magazine.—*W. L. Scofield.*

SARDINE FISHERY OF INDIA.

On the west coast of the Madras Presidency at the southern end of India is carried on a sardine industry under the supervision of the English government which, in quantity of sardines caught, exceeds that of any other sardine fishery in the world. We are prone to look upon the California sardine fishery with a catch of 160,000,000 pounds a year as the greatest, but the Madras yearly catch has exceeded 300,000,000 pounds.

The sardine of India is called in English the "oil sardine" while the native name is "nalla matti." It is a member of the great herring family and is called by icthyologists, no matter what their language, *Clupea longiceps.* It is different from the sardine of France and Spain and it is not of the kinds found in the United States or Japan. The reason we do not hear more of the Madras sardine is because very few of them are canned and for that reason do not find their way into our markets. They are a very fine food fish however and they may be the basis of a great sardine canning industry in the future. Many of them are now used for food fresh, as well as salted and dried, but the great bulk of the immense catch is converted into fish oil and fertilizer. This sardine oil and fertilizer industry of India is an ancient one which had its beginning centuries ago when the natives obtained the oil and used it as a paint to protect their wooden canoes and boats against the action of the sun and weather and also as a caulking material to make the planking of the larger boats water tight. The ancient process of obtaining the oil was to fill an old dugout canoe with sardines and after pouring boiling water on them they were left exposed to the sun until they are well putrefied. After the mass was sufficiently ripe, the ill smelling and rancid oil was skimmed off. The remaining mixture of fish was thrown on the beach to continue the process of decay and to become the breeding place of flies and other insects and vile smells. Later the fish which dried on the beaches were used to fertilize the tobacco fields, but the hardened oil remaining in the fish and the quantities of sand which adhered to the dried product made a very inferior fertilizer. The sand ingredient made trouble between producer and purchaser. The fertilizer was sold

by weight and the purchaser deducted an estimated amount for the sand. Human nature is probably not much different in Madras from what it is even here in California and we are safe in presuming that the fishermen were tempted to get in an excess amount of sand and the purchasers to make excessive deductions. At any rate it is recorded that on account of the sand the question of transporting the fertilizer any distance was a serious one.

The English have been able to change this and the natives now mostly boil the fish as soon as caught and then press out the oil with a combination oil press and filter. The fish remaining is dried either on mats in the sun or in ingeniously constructed solar heaters. There are over 600 small native plants engaged in this oil and fertilizer industry.

The sardines are caught during all the months of the year except June, July and August. The heavy weather during their southwest monsoon and their eighty inches of rain prevent fishing and drying during these months and the fish which are spawning during this time are provided by nature with a closed season.

The fishing methods are rather primitive, but they are effective nevertheless. The net most generally used is somewhat like a purse net but much smaller than those used in the United States. The net is operated by two paddle propelled canoes with six to eight men in each. When a school of sardines is located the two canoes separate and move around it in a circle, paying out the net as they go. When the two canoes come together on the opposite side of the school they begin hauling in the two ends of the net which hangs in the water like a wall around the school. A purse line running around the bottom is used to close the opening at the bottom when the net has been reduced to a narrow circle in the process of pulling in by the men in the two boats, thus preventing the escape of the fish under the net. When the net is very nearly all in the boats and the fish are bunched in a narrow space they are scooped out into the two canoes, each of which will hold about a ton. What the boats and net lack in size they make up in numbers, there being as many as two hundred pairs of boats at the fishing village of Tanur. On account of the small size of the boats they do not operate very far from shore nor very far from their home port. The introduction of larger boats operated by motors would greatly increase the catch. In some places large catches are made with large beach nets employing fifty men. The beach nets are only used in sheltered places and where the sardines come close in shore.

In the report of the Madras Fishery Board which tells of this interesting sardine fishery no mention is made of when the purse net was first used and we are left to infer that its use is nearly as ancient as the sardine oil and fertilizer industry itself. The purse net is supposed to have been invented by New England Yankees in 1826 * but it now seems probable that the idea first came from Indiia.

SARDINE POSSIBILITIES IN NEW SOUTH WALES.

In a recent report on the Fisheries of New South Wales we learn that they have a sardine along the coast of New South Wales which they identify as the species *Sardina neopilchardus* and which goes by the common name of pilchard, the common name applied by the Englihh to the European species. So far the fisheries of New South Wales have been little developed although the coastline within the hundred fathom line contains an area of 8,960,000 acres of prolific waters abounding in many kinds of edible fish, mollusks and crustaceans. Most of the fishing is carried on in inlets and estuarine waters. Out of 3164 fishermen operating during 1919, only 198 worked the ocean waters. We read further:

"When the purse seine net is brought into operation for commercial fishing in the coastal waters in the capture of the teeming masses of surface fishes, notably the pilchard and mackerel, the prosperity of the canning industry will be assured. We have a pilchard equal to the world's best sardine. So prolific is this fish that it is of no infrequent occurrance that the incoming shoal forces those closest inshore in masses high and dry on the beaches. It is officially recorded that in 1915 the Rose Bay baths, enclosing a water area of one hundred feet by eighty feet, became so full of pilchards driven in by the tunny that about two hundred baskets of the fish were scooped out, but the mass was so great that explosives had to be used to destroy the fish, and enable the baths to be cleared.

The neglect to use this bountiful harvest of the sea for food purposes is not owing to the careless indifference of the people, but merely indicative of the wonderful resources of our land which provides such quantities of meat-foods, that

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*See History of Purse Seine Fishery, by W. F. Thompson and Elmer Higgins, CALIFORNIA FISH AND GAME for July, 1923, p. 90.

attention is diverted from this source of supply.

The day can not be far distant when canning operations will commence in earnest, notwithstanding the climatic conditions, which are the chief deterring factors. Refrigeration and canning factories, once established, will justify the fishermen working a full six-day week, instead of as at present (as a rule) half that period, thus more than doubling the present output, which the source of supply would permit to expand enormously."—*N. B. S.*

TO SURVEY THE OCEAN.

At a recent meeting of representatives of the scientific branches of the government and other allied institutions held at Washington under the auspices of the United States Hydrographic Office, it was planned to make one of the most complete surveys of the ocean from top to bottom that has ever been attempted. The investigations will probably be confined to some restricted region, either the Atlantic or the Pacific. To quote from "*Science News*": "One or more ships will probably be fitted out with a complete laboratory and equipped with the latest scientific apparatus for the first cruise. The sea bottom will not only be mapped, but the composition of the water, its density, temperature and currents, which affect the distribution of marine plant and animal life will be studied at all depths. In emphasizing the importance of this investigation, it was pointed out that five-sevenths of the surface of our globe is covered by the waters of the seas. This water area can produce far more food than all the land can ever be made to yield, and one of the purposes of the expedition will probably be to take an inventory of such food possibilities which will be needed if our population continues to increase. Fish, mollusks and marine animals are dependent upon the microscopic plants that grow in the sea as far down as the sunlight penetrates. The floating mass of minute forms of vegetable and animal life, collectively called "plankton," varies greatly with slight changes in the temperature and composition of the sea water, acording to laws not yet discovered, but which the proposed expedition may aid in understanding.

The exploring ship will map the ocean bottom by means of the new sonic finder, which determines depths by measuring the lapsed time between sending down a sound and getting back the echo from the bottom. By this instrument, soundings can be made by a ship in motion and much more easily and quickly than by the old way of "heaving the lead."—*N. B. S.*

THE KILLER.

The killer whale (*Orca gladiator*), although one of the smallest of the whales, is famed for its fighting propensities. It is known to attack and kill the large sperm whale, but it is on the smaller sea mammals like the seals and sea lions that it generally exercises its talents. One killer has been seen to kill and devour four young fur seals in quick succession so that there is little doubt that the meals of the killers in the neighborhood of the Pribiloff Islands are extremely costly to our government. The killer is so small it is not hunted by the whalers. In fact, they do not consider him worth wasting a shot on even when he disports himself in front of the whaling gun. So it is seriously proposed that a sufficient bounty be paid by our government to encourage the destruction of this destroyer. It is stated by those competent to speak that a bounty on killers, in the North Pacific at least, would be an excellent investment for our government, for the fur seals which would be thus saved from destruction would be worth many times the amount which would be paid out in bounties.

It is, therefore, rather startling to learn that *Orca gladiator* is protected by law in New South Wales as stated in a report of that government; "In the interest of the whaling enterprise at Twofold Bay." That is the explanation given and we are left to guess how their protection aids the whaling enterprise. Can it be they drive the larger, more valuable whales in for slaughter, just as Norwegian fishermen, many of them, believe that whales drive the herring into the fjords where they are more easily caught in the nets? The herring move inshore in great schools at spawning time and attach their eggs to the rocks and sea weed in shallow water and the fishing season is during this shoreward migration of the herring. Whales may follow them in but it would be strange indeed if the instinct of the herring would not impel them to seek the shallow inshore waters at spawning time without whales chasing them.

This reminds us that at Monterey many fishermen and others, wise in the ways of fishes, believe that the whales drive the sardines into the bay where some eighty million pounds of them are caught each year for the canneries. They shake their heads and solemnly predict that the killing of whales for the Monterey Bay whaling station at Moss Landing will cause the decline of the sardine fishing in the bay. These predictions were made

several years ago when the whaling station was established. Since then the whales have become scarce and the number of sardines appears to be increasing. Sardines, unlike the herring, migrate from the shore to the open sea for the purpose of spawning. They are not driven out of the bay at spawning time by the whales, in fact they move out in obedience to a stronger instinct than fear. "That may be," admits our fisherman, "but the whales make them hurry back just the same."—*N. B. S.*

PURIFICATION OF OYSTERS AND CLAMS.

We predicted in the pages of this magazine several years ago that the attempts to free oysters and clams of possible disease germs would prove successful and that we would be able to raise these shellfish in our bays and estuaries and utilize them without danger to health, in spite of the contamination of these waters by city sewage.

The first experiments were carried out in Virginia with oysters in 1914. Further commercial tests were tried out in New Haven harbor. In 1920 work was begun on a commercial purification plant at Inwood, Long Island, under the supervision of the New York State Conservation Commission. The completed plant has been endorsed by state and federal health authorities. The oysters are placed in large tanks of water and sterilized with hypochlorite of sodium produced by electrolysis of the sea water. The sucess of this process is very important as it is becoming well nigh impossible to protect oysters and clams from contamination in our harbors and at the mouths of streams. A description of this plant and the process can be found in the 1922 annual report of the New York State Conservation Commission.—*N. B. S.*

SARDINES AND HERRING MAY BE USED FOR FERTILIZER IN BRITISH COLUMBIA.

The Canadian Fisherman reports that the Minister of Marine and Fisheries of Canada has announced through the Chief Inspector of Fisheries of British Columbia that herrings and pilchards (adult sardines) caught on the Pacific coast have been exempted from the fisheries act of the statutes of 1914 so that herring and sardines may now be fished for and caught for the purpose of converting them into fish meal, fertilizer, oil and such products.—*N. B. S.*

MARINE PRODUCTS OF COMMERCE.*

A new handbook of great use to all canners and dealers in marine products, under the authorship of Donald K. Tressler of the United States Bureau of Fisheries, is now available. The importance of such work is enhanced when it is not the product of a single individual. In this instance the names of seventeen collaborators are to be found on the title page.

The book is designed for both the scientific and the practical man, giving the canners and biologists a general survey of the fishery industries, pointing out their relative importance, indicating their location and describing the methods in common use. Simple language is used throughout. Two whole chapters in the book are devoted to the manufacture and refining of solar sea salt and the method used in California is particularly described. Two chapters are also devoted to the use of seaweeds in the manufacture of chemicals, a review of the kelp industry of California during the war being emphasized. Another chapter deals with edible algae and the agar industry. Pearls and corals are discussed in three chapters.

Under the general heading of "Fish and Fisheries" are chapters on the importance of the fisheries, fishery methods and gear, fish as food, and various methods of preserving fish. By-products which received treatment are: fish oils, fertilizer, meal, glue and isinglass. Final chapters in the book are devoted to mollusks, crustaceans, turtles and whales, while the last chapters are devoted to commercial sponges and some problems of the fishery industries. An appendix contains statistics of the fisheries by states and of canned fishery products, together with a list of common names and descriptions of marine fish and animals of commercial importance found in the United States and Alaska. Each chapter ends with a fine bibliography.

A few selected paragraphs may help to give some idea of the useful character of this book: "Most species of marine fishes vary in fat content with the season, the abundance of food and the state of development of the sex organs. The amino acids making up the proteins of fish muscle are the same as those of

*"Marine Products of Commerce: Their Acquisition, Handling, Biological Aspects and the Science and Technology of Their Preparation and Preservation," by Donald K. Tressler (The Chemical Catalog Company, Inc., New York), 1923; 762 pp.; 257 figs. in text.

chicken muscle and they are present in approximately the same proportion.

"Fish contains relatively large amounts of phosphorus which may be of value in nutrition.

"The proteins and fat in fish are easily digested and compare favorably in this regard with those of beef muscle. Moreover, the coagulable proteins of fish flesh have been shown to possess as valuable nutritive properties as those of beef muscle.

"Fatty fish, and especially fish livers, contain large amounts of the fat soluble vitamines and are valuable sources of these essential food factors."—Summary of "Fish as Food."

"The early Chinese immigrants recognized that the California abalones were equally as valuable food as the oriental *Haliotis* and began to gather these mollusks for their meat, which they dried and smoked and exported to China and Hawaii. Soon the Americans began to gather up the shells which the Chinese discarded; these were polished and made into various ornaments. As early as 1879 an important industry had sprung up; in that year over $127,000 worth of abalones were taken. The canning of abalones was commenced about the year 1905 at Cayucos, California; and during recent years an important abalone canning industry has come into existence. In 1917, five plants packed abalones but in 1921 only three plants canned abalones. One of these plants was in East San Pedro and the other two were located in Monterey, California. 1,481,170 pounds of abalones were taken in California during 1921. While this mollusk is found all along the Pacific coast from California to Alaska, the fishing is almost entirely confined to the coast south of Monterey Bay, California."

The writer, having once found it difficult to get reliable information on ambergris was delighted to find the following statement:

"Ambergris is a biliary concretion from the intestines of the sperm whale and is found sometimes in the animal itself, but more often floating upon the sea or in the sand on the sea-coast. It occurs in lumps varying from a few ounces to 200 pounds. It is of a solid waxy nature, mottled dull gray to black, and possesses a peculiar earthy odor. The specific gravity of ambergris varies from 0.780 to 0.926. Its melting point has been reported as varying from 60° to 65° C. It is soluble in ether and in the volatile and fixed oils.

"The principal constituent of ambergris is ambrein, a substance melting between 82° and 86° C., which Riban found to possess the formula $C_{23}H_{40}O_2$. Cole has found that a microscopical examination is the most acurate means of identifying the substance, as true ambergris contains many fragments of the chitinous parts of the internal shell of cuttlefish which serves as food for this whale.

"Ambergris has been used for centuries in certain sacramental rites. The chinese and Moros also use it medicinally.

"Its principal use in America and Europe is in fine perfumes, to which it is added as a fixative.

"The value of ambergris depends largely upon its scarcity at the time."

The relative importance of marine products is pointed out thus:

"Our only sources of food, upon which life is dependent, are agriculture and fisheries, the wild game of the forests no longer being a factor of economic importance. While the fisheries are nearly overshadowed by agriculture, yet they furnish products which could be dispensed with only with difficulty. The crops need not be sown nor cultivated yet furnish a bounteous harvest for the taking. Moreover, the annual product has been rapidly increasing in both quantity and value in recent years. The fisheries may be expanded greatly. The most reliable statistics available indicate that the annual products of the world's fisheries are valued in excess of a billion dollars. In making up the total for marine products, at least a hundred million dollars may be added to this, as the value of the salt, iodine, potash, pearls and miscellaneous products is not usually included in the valuation of the fisheries.

"It has been estimated that, taken as a whole, fishery products constitute less than three per cent of the world's food. However, in certain countries, as Norway and Japan, fish is a much more important food factor and may even make up ten per cent of the food.

"England, Japan, and the United States each produce about one hundred million dollars' worth of fishery products annually. In England and the United States, the industries are relatively small compared to agriculture, mining, and manufacturing. In England, the chief fisheries are those for herring, cod, haddock, and mackerel. The more important catches of fish in American waters include those listed above and also salmon, sardines, halibut, menhaden, shad, ale-

wives, and oysters, shrimp, and lobsters.

"In Japan, the marine fisheries occupy a place of importance comparable to that of no other large nation."

Never have we read over pages of a handbook that seemed to so satisfactorily cover the ground expressed by its title.—*H. C. Bryant.*

LIFE HISTORY NOTES.

THE OPOSSUM REACHES SEQUOIA NATIONAL PARK.

According to a report by Judge Walter Fry of Sequoia National Park, the opossum (*Didelphys virginiana*) is now invading the southern Sierra. Opossums first made their appearance in the Three Rivers District along the Kaweah River in September, 1924. By the twenty-fifth of the month they had extended their range, following the south fork, to the Alles Brothers' ranch some three miles up the south fork, and by the first of October they had moved up the east fork and middle fork of the river to the J. P. Godbey ranch, only a mile from the western boundary of the park.

Supposedly, the animals are the product of stock brought from Missouri and liberated in the district east of Visalia. The invasion may have been augmented by the dry season. One man at Three Rivers killed 26 opossums, of which 3 were adult males, 2 adult females, and 21 were young. The two females were carrying in their pouches 9 and 12 young respectively. The larger male opossum weighed over ten pounds.

THE RETURN OF THE ANTELOPE IN LASSEN COUNTY.

The writer has spent most of his time in Lassen County since 1890 and has closely watched its game. One of the most interesting things observed has been the ability of the pronghorn antelope to survive under adverse conditions.

During the nineties several bands, numbering from 20 to 50, were scattered over the Madeline plains and nearby tablelands in eastern Lassen County. During this period, the last band seen by the writer was a group of about 15 head in the spring of 1897. With the coming of the homesteader and the advance of the sheep industry, antelope almost entirely disappeared. Although I rode the range continuously, no more were seen until late in the fall of 1900, when quite a large band appeared on the range near my ranch. However, within a few days hunters from Susanville and other places were after them and I knew of about ten being killed. The band broke and scattered; three spent the entire winter of 1901 in sight of my house, but disappeared the following spring. From 1901 to 1909 a lone antelope was sometimes seen, then a pair, or sometimes a half dozen. By 1916 bands of 10 to 15 were not uncommon. In the fall of 1918 a herd of 75 appeared and in the fall of 1921 several bands of from 20 to 75 could be found in a day's ride. During the winter of 1924 the writer saw one band of 125 and believes there were 500 or more on this range. During the summer of 1924 the animals became more tame than ever before, scarcely running from an automobile, and could be found in most any of the fields of the large stock ranches. They travel over a wide range, and with the splendid protection given them by Nevada and the interest taken in them, the writer anticipates seeing their former haunts in northeastern California restocked. With a little help the antelope should again become common on the west side of the San Joaquin Valley.—*Will R. Horne, Ravendale, California.*

NOTE.—In connection with the above we fail to understand how the increase of antelope occurred by the splendid protection of Nevada without any sort of an adequate game warden service. We are inclined to believe that the increase of these animals was from the fact that a California warden was appointed to practically adopt them. When Mr. Newbert was appointed in 1911 there were by actual count 13 antelope. So well did the California warden of these animals do his duty that today there are quite a number of large bands of them. These animals are very migratory at certain seasons of the year, hence we believe the wrong construction has been placed on the reason of their protection and increase.—G. N.

MOUNTAIN LION KILLS BOY IN WASHINGTON.

In CALIFORNIA FISH AND GAME for April, 1923, (Vol. 9 pp. 45–48) a complete explanation was given of one of the only instances where a mountain lion has been known to attack a human being in California. It was shown that this lion was afflicted with the dread disease, rabies, as both of his victims apparently died with that disease. With this background attention is now called to an apparently authentic case of the killing of a boy by a mountain lion in the state of Washington near the Canadian line. From two written statements, one by R.

L. Nash, and another by P. Harris, a forest supervisor, sent us by W. L. Finley of Jennings Lodge, Oregon, the following has been gleaned:

James Fehlhaber, 13 years old, of small stature, an orphan, who was living with Mr. R. L. Nash at Okanogan, Washington, left Robert Nash's house at 11.30 a.m., Wednesday, December 17, 1924. When the boy did not return R. L. Nash and a Mr. Kelly started out about 10 o'clock that evening to search for him. The boy was found about 75 feet from the main trail at the base of a cliff. A study of tracks in the snow seemed to show that a mountain lion had come down a steep hillside quartering behind the boy. A leap of about 10 feet from the cover of brush appeared to have been made in striking the boy down. There was blood where he fell. Five feet away more blood was found. Apparently the lion had dragged the body from this point to the base of the cliff. The body was partially eaten and disemboweled. A spot as big as one's hand had been eaten from one thigh, both hands were gone, apparently eaten to the wrists, bones and all. Skin and flesh were eaten clean from the skull, face and neck so that no trace of hair remained. From the position of the boy's gloves his hands were probably bare, so that except for the thigh the lion had eaten only parts not covered by clothing.

When the boy's body was first found the coat, which had been pulled from the body, was placed over the head. When the body was removed an hour later the coat was not seen. The next morning it was found in a lair the lion had been using, about 200 feet from where the body was found. The coat, which was covered with blood, had been torn to shreds. This would indicate that the lion returned to his kill during the absence of Mr. Nash. This was also indicated by the tracks which were superimposed upon those of Mr. Nash.

At first it was thought that a lion killed on January 9th, eight miles east of Winthrop and some twenty miles northwest of the place where the boy was killed, was probably responsible. In view of later evidence, this was apparently another lion. Later in January a lion was killed by Mr. Charles Garratt, a ranger living 10 miles west of Okanogan, who had set a trap for coyotes. This was a young lion in good condition. Mr. F. G. Clifford of Brewster, bought the animal and examined its stomach. Here he found a considerable wad of human hair and small bones of the hand and wrist. The hair resembled closely that of the boy's. The stomach contained other kinds of hair and meat and the human remains were wadded up separately and easily distinguished. Mr. Clifford, however, substantiates his statements with a number of witnesses. Forest Supervisor Harris of the Chelan National Forests states that there is no reason to doubt his account.

Those seeking dependable information have sought authentic instances of the killing of human beings by mountain lions with largely negative results. This is apparently one of the first instances to be recorded, of an attack of this kind. This report should not lead people to believe that the mountain lion is a dangerous animal. It should be remembered that the common domestic dog claims many more victims annually than mountain lions, and one of the safest places to live is in mountain districts where mountain lions are abundant.—*H. C. Bryant, Berkeley, California.*

SOME BANDED BIRDS TAKEN LAST SEASON.

Dr. P. A. Webber of Sacramento, killed a cackling goose in Yolo County with band No. 303,502. On forwarding the band to the Bureau of Biological Survey at Washington it was found that this goose had been banded by O. J. Murie of Alaska during the summer of 1924.

Mr. J. Basileu killed a banded canvasback duck at El Verano, on November 20, 1924. The bird proved to be one banded by Mr. O. H. Jorundson, Stony Hill, Manitoba, Canada. The bird was caught by Mr. Jorundson in a muskrat trap and banded by him about April 25, 1923.—*H. C. Bryant, Berkeley, California.*

ELK IN DEL NORTE COUNTY.

Although it is known that a remnant of the vast herds of Roosevelt elk which formerly inhabited the northwest coast of California remains in Del Norte County, yet a report as to their present status is seldom seen. Mr. Thomas Kring of Orick recently reported that there are in the neighborhood of 100 individuals in the herd. The country where they range is very brushy and heavily timbered and it is very difficult to obtain reliable information as to the exact numbers. Residents of the vicinity believe that the herd is slightly on the increase.—*Earl P. Barnes, Eureka, California.*

CONSERVATION IN OTHER STATES.

WASHINGTON REPORTS GOOD YEAR.

According to partial figures released here by J. W. Kinney, state supervisor of game and fish, his department has shipped out to the various counties 17,000 game birds and 13,000 game-bird eggs since the first of April. He states that they still have on hand at the game farms approximately 5000 birds. These with the number of birds liberated and on hand in the various counties make a total of close to 30,000 birds raised this year.

The department has imported several bamboo partridges and Chinese pheasants from China and at the present time is receiving from 100 to 500 birds from there each week.

The bamboo partridge is very similar in appearance and habits to the Hungarian partridge but it is thought by game specialists here that they are easier to raise in captivity. Already several of the birds have been raised on the game farm.

In the last 8 months the department has planted 26,000,000 trout fry and fingerlings and have shipped out 5,500,000 trout eggs to those counties having hatcheries. In addition to these they have on hand 22,000,000 trout fry and spawn in the State hatcheries.

Bass, crappies, and other spiney rayed fishes to the number of 1,800,000 were planted in eastern Washington lakes during the period. Supervisor Kinney has avowed his intention of putting fish in every stream, lake, pond and pothole in the state.

WEST VIRGINIA STARTS GAME BIRD FARM.

At the request of the Game and Fish Commission of West Virginia the state has purchased two tracts of land, one to be used as a game bird farm and the other for a state forest park and game reserve. This is to be but the first unit of a great system of public-owned forest extending throughout the mountainous region of the Appalachians. The first area acquired was a tract of 10,700 acres. A second tract of about 225 acres of upland farm and woodland is to be used for the propagation of game birds. Plans are being made to experiment with Hungarian partridges and bob white quail, although emphasis will be placed upon ring-necked pheasants.

THE DEER-KILL IN VERMONT.

During the open season of 1923, acording to the twenty-seventh biennial report of the Department of Fish and Game of Vermont, the deer-kill totaled 685, which seems a fair showing for a state once entirely depleted of deer, but now efficiently restocked. Vermont is one of the few states that pays damages for depredation committed by deer. During the season 1923–24 total damage claims amounted to $2,131.96. The income from hunters and anglers licenses in this state for the year ending June 30, 1923, was $6,438.42. Vermont supports three hatcheries and one auxiliary station.

OREGON'S ACCOMPLISHMENTS.

According to the 1924 biennial report of the Game Commission of Oregon, pheasants to the number of 21,822 were planted during the biennial period. Lion bounties to the sum of $2,575 were paid on 159 lions. Bounties were also paid on 29 wolves and 66 wildcats.

FINLAND PASSES PROTECTIVE LAWS.

On July 1, 1923, a law for the protection of nature was passed in Finland. This law prohibits the sale of feathers of wild birds for millinery purposes, and some twenty-six species of birds are given total protection. The use of the pole trap is forbidden.

NEW YORK ANGLERS DEMAND BETTER PROTECTION FOR FISH.

Anglers in New York are seeking additional means of giving better protection to fish. According to reports, trout fishing in the rivers and lakes of the Adirondacks is getting poorer with each succeeding year in spite of the fact that these waters are being continually restocked. The blame for conditions is placed upon the taking of fish from feeder sources. It is claimed that in the state of Maine, fishing, under similar conditions, has been improved greatly by protecting the small trout in small streams. The State Conservation Commission is being asked to close all brooks and small streams, which may be tributary to rivers, lakes and ponds inhabited by trout.

PENNSYLVANIA ORDERS MEXICAN QUAIL.

According to newspaper reports the game commissioners of Pennsylvania have ordered 10,000 Mexican quail for introduction into that state.

Each of the ring-necked pheasants to be planted this year will be banded. It is believed that the information as to the place where it was taken, together

with the information obtainable as a result of the band, will help greatly in planning future plantings.

POLLUTION KILLS FISH IN CHESAPEAKE BAY.

Reports from Maryland that large numbers of fish were dying in Chesapeake Bay resulted in investigations by the United States Bureau of Fisheries. Mr. H. S. Davis, Pathologist, spent some time in the region. Apparently, mortality was not confined to any one species, many varieties suffering alike. In practically all instances blame was placed upon pollution of streams running into the bay. In one instance oily material was particularly noticeable on the surface of the water where the dead fish were found.

It seems reasonable that we must expect similar destruction of fish life in increasing amount if we continue to pollute our fresh water streams with sewage and other waste.

PENNSYLVANIA BLACKLISTS VIOLATORS.

Pennsylvania has blacklisted nearly 100 hunters who were guilty of violating fish and game laws last season. No licenses will be granted to these hunters the coming season and it is doubtful whether any of them will care to exercise the privilege without a license in that the law provides for a fine of $40 for each day they hunt if they secure licenses under their own or assumed names.

NEW MEXICO ADVOCATES FARM REFUGES.

A special committee investigating the status of quail in New Mexico advocates elastic seasons and farm refuges as a means of determining causes of decrease and suggests that over-grazing may well be considered one of the important factors. As a specific program looking toward increase of quail this committee advocates:

1. Conserving brush and patches of weeds.
2. Regulating spring burning.
3. Destruction of vagrant house cats.
4. Control of sharp-shinned hawks.
5. Limitation of killing on private grounds.
6. A covey limit.
7. Regulation of tourists.
8. Reductiin of bag limit from 20 to 15.

MINNESOTA DEMANDS GREATER FIELD FORCE.

A minimum of 200 all-year-round salaried wardens in the 87 counties of Minnesota would not be too large a number of men to properly take care of the natural resources of the state in the line of fish, game and fur-bearing animals. Minnesota's Commissioner is quoted as saying: "At present there are eighty-odd wardens and refuge patrolmen on duty. So urgent is the need for better enforcement that an emergency or deficiency appropriation of $50,000 is asked to care for the situation until the beginning of the new fiscal year.

Sportsmen of this same state are using the slogan: "Oust the spear and net from Minnesota waters" based on the plea that if Minnesita is to maintain her place as the great playground of the nation, revolutionary measures must be inaugurated in order to protect and preserve fish, which is the great attraction for the hundreds of thousands of summer visitors.

VIOLATIONS OF THE FISH AND GAME LAWS.

GAME CASES.

October, November and December, 1924.

	Number arrests	Fines imposed	Jail sentences (days)
Violations of Hunting License Act	59	$985	
Deer—killing, possession, closed season	10	425	50
Deer—removal of evidence of sex from hide	6	150	
Deer—killing, possession, does, fawns, spike bucks	6	500	50
Elk—killing, possession	3	Pending	
Ducks—killing, possession, over bag limit	6	175	
Ducks—sale	2	25	
Ducks—killing, possession, closed season	4	25	
Geese—killing, possession, over bag limit	1		25
Mudhens—killing, possession, over bag limit	1	25	
Swans—killing, possession	5	125	
Doves—killing, possession, closed season	3	50	
Wild pigeons—killing, possession	3	75	
Shorebirds—killing, possession	4	100	
Quail—killing, possession, closed season	12	345	
Pheasants—killing, possession	4	225	
Rabbits—cottontail, killing possession, closed season	6	180	
Squirrels—killing, possession	2	25	30
Non-game birds—killing, possession	40	845	
Trespass	2	40	
Shooting game from power boat, automobile	2	125	
Night hunting	51	1285	375
Violations of Fur Trapping Regulations	2	20	
Game refuge—hunting or possession of firearms	6	150	
Totals	240	$5,900	530

SEIZURES OF FISH AND GAME.

October, November and December, 1924.

Ducks	726	Skunk skins	2
Geese	23	Mink skins	1
Doves	2	Trout, pounds	79
Shorebirds	5	Striped bass, pounds	9,740
Swans	2	Salmon, pounds	2,714
Mudhens	4	Clams	1,805
Quail	10	Lobsters, pounds	1,486
Pheasants	5	Crabs	301
Non-game birds	5	Abalones	118
Deer meat, pounds	105	Sturgeon, pounds	156
Deer heads	2	Spotfin croaker, pounds	60
Deer hides	1	Nets, seines	5
Elk meat, pounds	40	Crawfish traps	66

FISH CASES.

October, November and December, 1924.

	Number arrests	Fines imposed	Jail sentences (days)
Vioations of Angling License Act	10	$260	
Violations of Commercial Fishing Liense Act	3	50	
Trout—closed season	3	100	
Trout—over bag limit	3	75	
Striped bass—undersized, over bag limit	17	460	
Striped bass—closed season	3	100	
Salmon—closed season	1	100	
Salmon—over bag limit	2	25	
Crabs—undersized	5	110	
Clams—undersized, over bag limit	88	2,800	200
Abalones—undersized, over bag limit	19	550	90
Lobsters—undersized, oversized	6	155	
Spotfin croaker—purchase, sale	1	10	
Illegal night fishing	3	50	25
Fishing within 100 feet of dams or within 250 feet of fishways	6	125	40
Nets, traps—illegal possession or use	10	555	200
Totals	180	$5,525	555

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF OCTOBER, NOVEMBER AND DECEMBER, 1924.

Species of Fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Alameda, Contra Costa	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego, Imperial	Total	Mexican, brought into California via San Pedro	Mexican, brought into California via San Diego
Albacore									420		206,337	80	809	207,646	377	
Anchovies											10,145			10,145		
Barracuda										25,510	485,756		49,903	561,169	809,070	139,902
Bluefish								716	2,766					3,482		
Boccaccio							3,805	4,737	121,660	1,876				132,078		
Bonito									20	1,145	331,650	18	49,666	382,499	17,202	11,706
Carp		4,368		193	4,859	3,337								12,757		
Catfish		42,574		252	65,363	36,004								144,193		
Chilipepper								1,023	8,105					9,128		
Cultus Cod	28	2,518					75,199	13,401	57,744					148,890		
Dolphin																
Eels																
Flounders	1,334	130		823			106,846	32,028	99		5		50	141,315		274
Grayfish						24,112	34,340	6,900					67,684	111,336		
Greenfish																
Hake							18,328	2,375						20,703		
Halibut	1,255						854	512	675	106,934	81,970	3,220	43,979	239,399	42,841	199,509
Hardhead					11,780									11,780		
Herring	1,701		4,763			6,800	103,197			202			9,423	126,086		
Kingfish								1,548	11,264		98,908	20	3,100	114,840		
Mackerel									140,779	8,034	573,797	75,778	106,651	905,039	3,092	4,504
Marlin																
Mullet												240	852	1,092	819	5,410
Perch	2,897		10,650				15,872	4,130	3,959	22	20,788	40	222	58,580	935	1,453
Pike				46	239	942								1,227		
Pompano											129		60	189	398	220
Rock Bass											27,904	5,410	11,796	45,110	5,742	14,305
Rockfish	1,023	4,135					79,219	23,545	73,618	4,087	340,063	17,448	421,925	965 063	8,722	4,281
Sablefish							72,747	159,475	1,245					233,467		
Salmon	1,515,60			26,296	45,102	24,363								247,321		
Sand dabs		5,780					353,442	40,287	144		1,463	28		401,144		
Sardines		125	345				540,775		50,067,996		55,807,169	1,400	1,729,743	108,147,553		
Sculpin											21,349	315	11,360	33,024		
Sea Bass—Black										674	4,980	7,352	17,564	30,570	2,309	48,457
Sea Bass—White			5,701				4,353		103	19,890	20,619	1,740	39,695	92 101	66,537	
Sea Trout													504	504		29,664
Shad				266	737	6,089								7,092		2,529

Shad—Buck						46								46		
Shad—Roe									122	4,078	11		7,814		370
Sheepshead										1,499		3,603	36,225		
Skates							32,651	2,075		81,139		82,340	164,144	1,310,752	190,634
Skipjack								635	30						
Smelt	5,985	2,141	2,208				16,033	7,515	14,732	38	54,909	47,946	8 445	159,952	2,218	260
Sole		77,360					1,713,935	167,057	1,231	17,288	11,391	394	3,174	1,991,830	765	2,455
Splittail					538	42								580		
Striped Bass				6,723	26,003	119,956	320		64					153,066		
Stingaree																
Suckers		1,788			19									1,807		
Surf Fish																
Swordfish										472		1,871		2,343		
Tomcod							2,878	8,487						11,365		
Trout—Farm																
Trout—Steelhead	60													60		
Tuna										8,820				8,820	37,506	
Tuna—Bluefin																
Tuna—Yellowfin										2,744		48,753		51,497	1,319,217	315,242
Turbot			821											821		
Whitebait	285		25				2,956		120					3,386		
Whitefish										28,723		34,283		63,006	1,383	3,649
Yellowtail										205,396	239	266,551		472,186	608,710	279,938
Miscellaneous		250			31		4,000	222	4,735	4,580	49,251	3,564		66,633	1,236	737
Total fish	166,128	141,169	24,513	34,599	154,671	199,991	3,181,750	476,668	50,511,509	190,402	58.481,454	165,243	3,014,006	116,742,103	4,239,831	1,255,499
Crustaceans																
Crabs	[1]31,512	[2]3,864	[3]1,080			[5]96	[6]537,816	[8]21,264	[9]18,648					[10]614,280		
Ecrevisse																
Shrimps			239,927				155,009							394,936	1,381	256,647
Spiny Lobsters										32,242	91,658	10,138	63,731	197,769		
Mollusks																
Abalones									552,340	1,965				554,305		
Clams—Cockle			491								365			856		
Clams—Mixed	4,185		10,696								120	622		15,623		
Clams—Pismo										76,213				73,213		
Clams—Softshell		357	23,040			24,706	12,065							60.168		
Cuttlefish							1,479	13,743	28,993		74			44,289		
Limpets																
Mussels						20	1,440			161				1,621		
Oysters—Eastern			[4]106,304				[7]95,282							[11]201,586		
Oysters—Native																
Snails																
Squid									161,407		148			161,555		
Miscellaneous																
Frogs																
Terrapins																
Turtles																
Totals	201,825	145,390	406,051	34,599	154,671	224,813	3,984,841	511,675	51,272,897	300,983	58,573,819	176,003	3,077,737	119,065,304	4,241,212	1,512,146

All amounts shown in pounds unless otherwise specified. Albacore and skipjack cleaned.

[1] 1313 dozen.
[2] 161 dozen.
[3] 45 dozen.
[4] 483,200 shell oysters.
[5] 4 dozen.
[6] 22,409 dozen.
[7] 433,100 shell oysters.
[8] 886 dozen.
[9] 777 dozen.
[10] 25,595 dozen.
[11] 916,300 shell oysters

STATEMENT OF INCOME.

For the Period October 1, 1924, to December 31, 1924, of the Seventy-sixth Fiscal Year.

	Detail	Total
License sales:		
Angling	$62,295 00	
Hunting	100,661 30	
Market fishermen's	6,410 00	
Trapping	1,956 00	
Wholesale fish packers' and shell fish dealers'	85 00	
Game breeders'	17 50	
Total license sales		$171,424 80
Other income:		
Court fines	$10,540 00	
Fish packers' tax	20,059 36	
Fish tag sales	1,946 29	
Game tag sales	25 25	
Interest on bank deposits	394 79	
Sale of transcript	15 80	
Total other income		$32,981 49
Total income		$204,406 29

STATEMENT OF EXPENDITURES.

For the Period October 1, 1924, to December 31, 1924, of the Seventy-sixth Fiscal Year.

Function	Materials and supplies	Salaries and wages	Service and expense	Property and equipment	Total
Administration:					
Commissioners			$0 75		$0 75
Executive offices	$41 01	$4,279 34	1,303 54	$76 40	$5,700 29
Printing	2,739 85				2,739 85
Research and publicity	169 68	1,263 29	140 08		1,573 05
Accident and death claims			32 14		32 14
Department totals	$2,950 54	$5,542 63	$1,476 51	$76 40	$10,046 08
Commercial fishculture and conservation:					
Superintendence	$798 75	$2,649 00	$926 61	$4 90	$4,379 26
Inspection and patrol	794 07	4,255 81	1,322 18	32 75	6,404 81
Research	127 57	3,801 61	545 51	143 48	4,618 17
Statistics	250 40	1,402 58	78 97		1,731 95
Propagation and distribution of salmon	930 83	5,392 37	166 12	14 50	6,503 82
Department totals	$2,901 62	$17,501 37	$3,039 39	$195 63	$23,638 01
Sporting fish culture:					
Superintendence	$13 81	$2,515 00	$557 63		$3,086 44
Special field investigation	74 06	640 32	278 89		993 27
Printing	20 15				20 15
Propagation and distribution of trout	4,791 29	12,611 21	1,689 72	11,182 15	30,274 37
Department totals	$4,899 31	$15,766 53	$2,526 24	$11,182 15	$34,374 23
Patrol and law enforcement:					
Prosecutions and allowances			$30 59		$30 59
General patrol	$405 00	$35,366 61	23,275 25	$110 00	59,156 86
Department totals	$405 00	$35,366 61	$23,305 84	$110 00	$59,187 45
Fish and game conservation:					
Game bird introduction					
Mountain lion hunting		$375 00	$203 23		$578 23
Mountain lion bounties			2,070 00		2,070 00
State Fair exhibit	$128 50	27 00			155 50
Department totals	$128 50	$402 00	$2,273 23		$2,803 73
License commissions			$15,366 70		$15,366 70
Tahoe camping ground					
Grand totals	$11,284 97	$74,579 14	$47,987 91	$11,564 18	$145,416 20

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